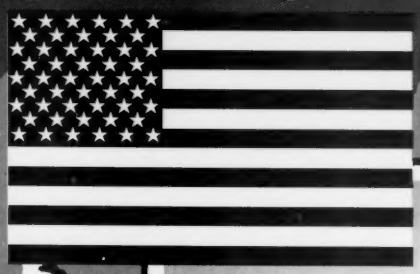
UNITED STATES ARMY

JANUARY/FEBRUARY 1991

AVIATION DIGEST



AVIATION DIGEST

PROFESSIONAL BULLETIN

1-91-1 • JANUARY/FEBRUARY 1991

1 **Sweeping Cultural Changes in Army Aviation,** MG Rudolph Ostovich III

2 **Desert Shield and the Army Aviation National Maintenance Point,** LTC Roy Oler

6 **Anytime, Any Place,** Mr. Warren Schnell and Mr. Eugene McDonald

8 **Providing Engineering Support to Operation Desert Shield,** Mr. William S. McDonald

12 **Readiness and Conservation, Partners in the Persian Gulf,** Mr. William H. Arnette

13 **M-130 Flare/Chaff Dispenser**

14 **U.S. Army Aviation Center Aircraft Maintenance Contract,** LTC W. Larry Dandridge

24 **PEARL'S: Sand, Sun, and Survival; Western Region ALSE/ Survival School; ALSE Shops**

26 **Aviation Medicine Report: Face of Death,** 1LT G. Habermehl

28 **Operations in the Desert: We Fought (and Died) the Way We Trained,** CW2 Victor E. Carlin

36 **Views From Readers**

37 **Aviation Personnel Notes: Army Aviation Personnel Plan (A2P2); Changes to Army Regulation 611-201**

38 **USASSO Sez: FLIP Account Managers,** MSG(P) Walter McPherson

40 **ATC Focus: The Digital Bright Radar Indicator Tower Equipment System,** MSG Chet Spangler

42 **Aviation Logistics: Test Pilot Standardization,** LTC Douglas A. Cahill

44 **DES Report to the Field: Enlisted Crewmembers: To Pay or Not to Pay?,** SFC Drake Willoughby

46 **Apaches at the NTC—They're Here,** MAJ Michael L. Poumade

52 **Winning in the Desert, Part 2**

Back Cover: **U.S. Army Aviation Digest Author's Guide**

Cover: **The cover pays tribute to the people of the Army Aviation National Maintenance Point, U.S. Army Aviation System's Command, in CONUS and in-theater, who are providing maintenance and logistics suppport to Army Aviation deployed forces in Saudi Arabia.**

Major General Rudolph Ostovich III
Commander, U.S. Army Aviation Center

Patricia S. Kitchell
Editor

By order of the Secretary of the Army:
Carl E. Vuono
General, U.S. Army
Chief of Staff

Official:
William J. Meehan II
Brigadier General, U.S. Army
The Adjutant General

The mission of the *U.S. Army Aviation Digest* professional bulletin (USPS 415-350) is to provide information of an operational, functional nature concerning safety and aircraft accident prevention, air traffic control, training and doctrine, maintenance, operations, research and development, aviation medicine and other related data. Information contained in this bulletin does not change or supersede any information presented in other official Army publications.

The *Digest* is an official Department of the Army professional bulletin published bimonthly under the supervision of the commander, U.S. Army Aviation Center. Views expressed herein are not necessarily those of the Department of the Army nor the U.S. Army Aviation Center. Photos are U.S. Army unless otherwise specified. Use of the masculine pronoun is intended to include both genders unless otherwise stated. *Material may be reprinted provided credit is given to the Aviation Digest and to the author unless otherwise indicated.*

Articles, photos and items of interest on Army Aviation are invited. Direct communication is authorized by writing Editor, *U.S. Army Aviation Digest*, ATZQ-AP-AD, Fort Rucker, AL 36362-5042, or by calling either AUTOVON 558-3178 or Commercial 205-255-3178. Manuscripts returned only upon request.

Second class postage paid at Daleville, AL, and additional mailing offices.

Active Army, Army National Guard and U.S. Army Reserve units receive distribution as outlined in DA Pamphlet 25-33. To complete DA Form 12-99-R, enter form number 12-05-E, block number 0014 and quantity. Also use DA Form 12-99-R for any change in distribution requirements. Submit to your publications control officer.

Personal copies of the *Digest* can be ordered from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

POSTMASTER: Send address changes to Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

Major General Rudolph Ostovich III
Chief, Army Aviation Branch

Sweeping Cultural Changes in Army Aviation

In today's world of changing political alignments and lessened emphasis on traditional doctrine designed to fight on the European battlefield, Army is forging a warfighting philosophy emphasizing a variety of missions likely to occur worldwide. Nowhere is this more profoundly evident than in aviation. Modern aviation systems provide commanders formidable tactical and operational force multipliers. Multirole characteristics present today, and more so in future aircraft, provide capability for a variety of missions over a wide range of contingency scenarios.

This revolutionary application of aviation requires responsive maintenance and logistics support. To meet this challenge, aviation maintenance is improving its policies and programs. Increased emphasis on RAM-D (reliability, availability, maintainability, and durability); improved management policies; new maintenance initiatives; and restructure of our maintenance organizations will meet aviation's new support requirements.

Modern aircraft, with high-tech components and composite structures, need increased emphasis on RAM-D during development. In the past, we have experienced problems with systems with insufficient priority on RAM-D. New weapons systems are being developed with more stringent reliability standards. LH is a case in point. We place an increased effort on RAM-D during development, which translates to improved mission effectiveness.

Another important consideration for increasing mission effectiveness is the amount of time allocated and effort expended on systems maintenance. Historical data have shown phase time for aircraft is significantly reduced when the priority is day-to-day maintenance management. Assigning a dedicated crewchief to each aircraft, prephase planning, experienced phase teams, and command emphasis at all levels are examples of maintenance management policies that increase the effectiveness of maintenance programs.

As a result of the July 1990 Aviation Systems Program Review (ASPR), we are embarking on initiatives that will start a sweeping cultural change in the way we perform our maintenance mission: An apprentice mechanic program; placing skilled senior NCOs on the flightline; increased time devoted to maintenance functions; and increase in the ratio of mechanics to aircraft.

The apprentice mechanic program as a training strategy falls in line with the Army's current trend toward distributive training. Soldiers receive formal, schoolhouse instruction in fundamental maintenance practices and then report to maintenance units for supervised, hands-on aircraft systems training, which extends throughout their first term of enlistment. On re-enlistment, they receive training (BNCOC) in advanced mechanical and leadership skills before returning to a field assignment.

With the apprentice mechanic program, we are working to retain soldiers in pay grades E6 and E7 on the flightline where their maintenance skills are best applied. This system will meet the demands of more sophisticated aircraft and armament systems.

We are formulating another initiative addressing the time maintainers spend performing productive maintenance. The ASPR showed we can improve the time maintainers actually maintain as opposed to non-MOS related duties. The fact that aviation mechanics typically spend only 23 percent of each duty day performing productive aircraft maintenance makes achieving DA readiness standards extremely difficult.

An analysis of Army Aviation's personnel-to-equipment ratio revealed that, despite the cost and complexity of aviation systems, our battalions actually receive fewer maintainers per end item than our mech infantry and armor battalion counterparts. To alleviate this situation, manpower levels will be increased in attack helicopter battalions to one crewchief per aircraft.

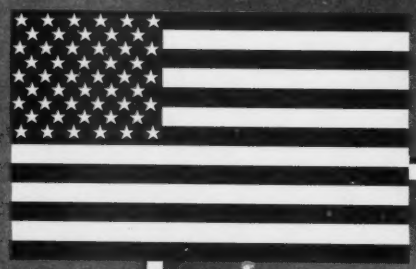
Under the AirLand Battle-Future concept, we are restructuring the Army into a lighter, more mobile and effective fighting force. We are examining ways to build aviation units and supporting structure into a force that can perform any mission worldwide. The future operational maintenance company (OMC) and operational maintenance battalion (OMB) will significantly improve aviation maintenance and logistics for tomorrow's fleet. Under the OMC/OMB concept, consolidated and concentrated manpower will increase aircraft availability by decreasing turnaround time for scheduled inspections and repair of battle damage.

Recent events proved the capability and impact of Army Aviation on the battlefield. We are constantly looking for innovative ways to improve that capability. No matter what the mission or environment, Army Aviation will be expected to perform. I'm confident that our aviation force—today's and tomorrow's—will meet these challenges and continue to demonstrate its relevant contribution to combined arms warfare.

DESERT SHIELD

and the Army Aviation National Maintenance Point

Lieutenant Colonel Roy Oler
Chief, Maintenance Operations Center
Directorate for Maintenance
(Desert Shield Operations)
St. Louis, MO
(Currently TDY to Saudi Arabia)



WE AT THE Army Aviation National Maintenance Point (NMP), U.S. Army Aviation Systems Command (AVSCOM), St. Louis, MO, have dealt with many crisis situations and military deployments in the past. Never in the history of the country, however, has the U.S. Army deployed as many forces as fast as during the outset of Operation Desert Shield.

Putting a support structure in place and making it work right for Army Aviation deployed forces continues to take the talents of many disciplines of which our maintenance people at the NMP play no small part. This issue of the *Aviation Digest* is dedicated to those having a part in getting an Army Aviation maintenance program started in Saudi Arabia, those who have had a part in keeping it going, and those responsible for making it continue to work.

The personnel at the NMP are dedicated to the continued support of Desert Shield. This support stems from AVSCOM's aviation maintenance responsibilities—maintenance engineering, maintenance operations, maintenance management, parts provisioning, technical and maintenance publications, and training. This support is only one segment of the overall AVSCOM presence with Operation Desert Shield.

NMP support is managed through an AVSCOM Forward organization as shown in figure 1. This organization is the clearinghouse and expeditor for AVSCOM interest and activities in and out of the area—a busy place indeed!

Theater Aviation Maintenance Program—Saudi Arabia

With this in mind, we at the NMP want to tell you about our maintenance operations element, better known as Theater Aviation Maintenance Program - Saudi Arabia (TAMP-SA). What it is, what it does, and some of the activities taking place to support Army Aviation in Saudi Arabia follow.

Basic Mission of TAMP-SA

The basic mission of TAMP-SA, in support of deployed units, is as follows:

- Provide maintenance and limited depot-level repairs of aircraft, their engines, and components.
- Install modification work orders (MWOs).
- Provide on-site technical assistance through the use of engineers, logistics assistance representatives, and contract field service representatives.
- Evaluate environmental impacts associated with desert operations and develop preventative maintenance to counter these impacts, thereby extending the life of aircraft and their components.
- Fix things forward to ease the pressure on extended maintenance and supply pipelines.

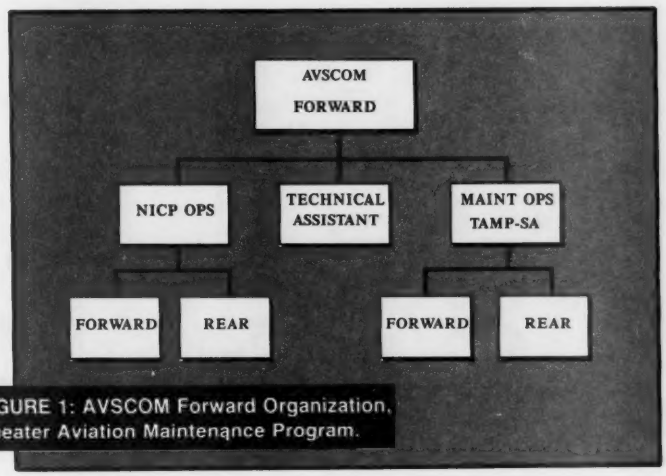


FIGURE 1: AVSCOM Forward Organization, Theater Aviation Maintenance Program.

Specific Activities of TAMP-SA

TAMP-SA provides armament support for AH-64 Apache and AH-1 Cobra helicopters. It provides engineering support on nonstandard repairs.

TAMP-SA operates a turbine engine service center designed to eliminate unnecessary engine removal by the following actions:

- Testing engines on the aircraft with portable engine analyzer test sets.
- Providing technical assistance to maintenance units for troubleshooting and aircraft engine repair.
- Performing limited depot repairs without removing the engine from the aircraft.
- Developing preventive maintenance measures to prolong engine life during desert operations.

TAMP-SA (Base)

TAMP-SA (Base) (figures 2 and 3), located in Abu-Dhabi, United Arab Emirates, is capable of performing general and specialized tasks:

- Limited depot repair of selected components.
- Off the aircraft repair of turbine engines and testing the engines on an engine test stand.
- Heavy sheet metal repairs, corrosion control, and aircraft painting.
- Special repair activities to support target acquisition and designation sights/pilot night vision sensors; integrated helmet and display sights systems; mast-mounted sights; selected Apache components; and selected U.S. Army Communications-Electronics Command-managed items.
- AVSCOM's forward-deployed aviation intensive management items point.

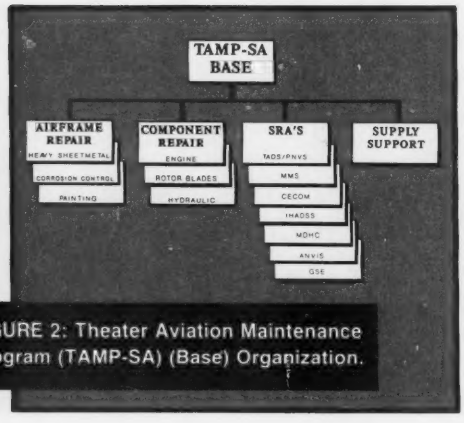


FIGURE 2: Theater Aviation Maintenance Program (TAMP-SA) (Base) Organization.

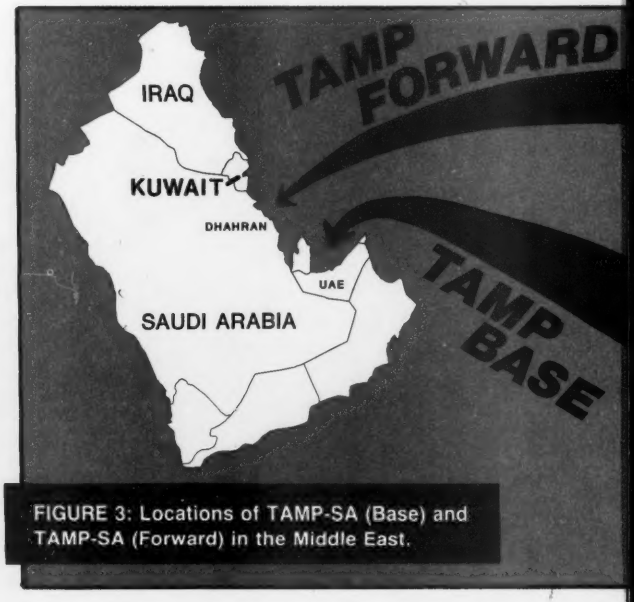


FIGURE 3: Locations of TAMP-SA (Base) and TAMP-SA (Forward) in the Middle East.

TAMP-SA (Forward)

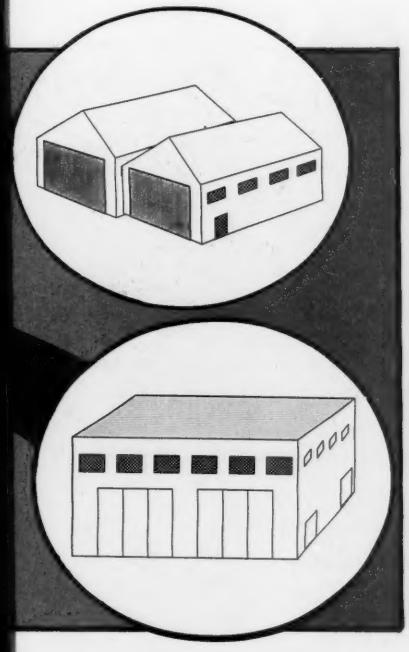
TAMP-SA (Forward) (figures 3 and 4), a forward-deployed subelement of TAMP-SA, is located in Dhahran, Saudi Arabia. It is capable of performing the following tasks:

- Offloading of aircraft arriving in Saudi Arabia.
- Augmenting aviation maintenance units, providing backup maintenance support, and installing MWOs.
- Applying an erosion protection tape to helicopter rotor blades (Rotor Blade Erosion Control Program) and exchanging these in shipsets with unprotected blades.

Interface

The interface between the NMP and the TAMP-SA is only one example of how we react to maintenance requirements of Desert Shield. Current efforts and activities at the NMP specifically in support of Desert Shield and Army Aviation maintenance as a whole follows in the next three articles.

A cadre of both military and government civilians man TAMP-SA. The actual workforce is predominately contract personnel. TAMP-SA has been designed with flexibility and the capability to expand and contract to meet the requirements of our forward-deployed aviation forces.



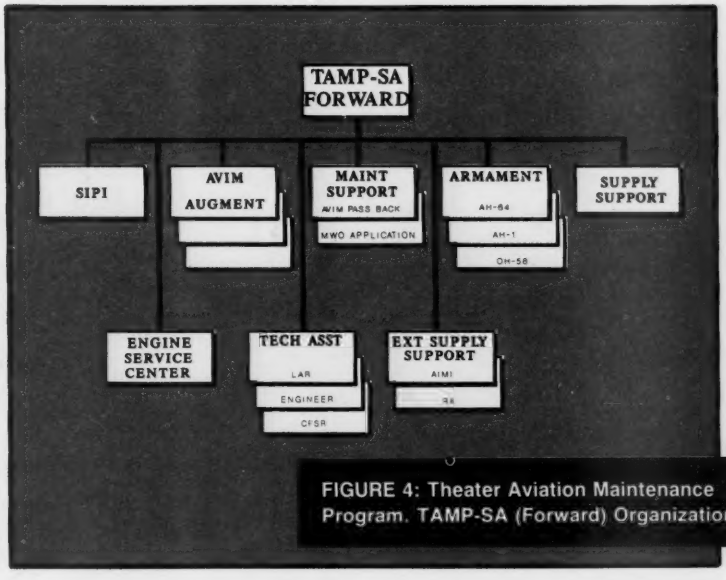
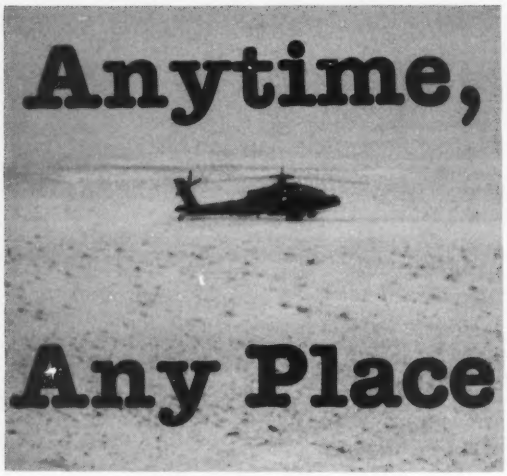


FIGURE 4: Theater Aviation Maintenance Program. TAMP-SA (Forward) Organization.



Mr. Warren Schnell
Chief, Technical Publications Branch

Mr. Eugene McDonald
Chief, Provisioning Branch

Directorate for Maintenance
U.S. Army Aviation Systems Command
St. Louis, MO

THE AIRCRAFT has become what the locomotive was in the 19th century: the stuff dreams are made of. Mention that you work in aviation and the listener invariably responds with a knowing nod of his head. Then he reminisces on his own perception of aviation. Ask him about his own aviation experiences and, most likely, he will respond with stories about a shining aircraft on which he traveled to some exotic vacation spot and an airport tarnished by inconveniences, but one of order and cleanliness.

Those of us who work, fly, or fight with Army Aviation have a different perspective of aviation. Aviation, to us, is mud and dirt. A shining aircraft is not our goal. To us, it can be the target of a heat-seeking missile.

At the U.S. Army Aviation Systems Command (AVSCOM), St. Louis, MO, we have spent more than 30 years honing our operational and maintenance concepts to support the Army Aviation mission anywhere in the world. With justifiable pride, we can point to our record and creed: *Be ready anytime and at any place.* We have tested ourselves and our machines during maneuvers and combat in widely divergent environments. We have developed confidence in aviation. That confidence has been touched, just a bit, by the romance of aviation as seen through our eyes and the eyes of others—shining aircraft and exotic destinations.

However, Operation Desert Shield has been a cultural shock. Army Aviation has responded with excellent readiness rates; but it has been quite different than practicing our skills and talents in the Mojave Desert. The combination of fine airborne sand and unremitting high temperatures has resulted in a number of changes to our maintenance and operational procedures. Distances and a different culture have also tested our logistical abilities to provide spare parts and manuals.

AVSCOM has responded to these challenges in a number of ways. As a result of the ever-present sand, we published Technical Bulletin (TB) 1-1500-200-20-29, *Preventive Maintenance for Army Helicopters: AH-64, UH-60, CH-47, UH-1, AH-1, and OH-58 Helicopter*, on 1 October 1990. This general publication emphasizes the importance of cleaning sand from hydraulic actuators, avionic bays, auxiliary power units, radiators, and heat exchangers. Users have been encouraged to protect parked aircraft from sand intrusion by covering cyclic and collective grips with small plastic bags and covering control consoles with plastic sheets—securing both with tape.

Increased parts usage and different environment have resulted in a reevaluation of our current time between overhaul (TBO) times. As a result, we released TB 55-1500-200-30-1,

Extended Time Between Overhaul (TBO) Hours for Combat Desert Operations, on 19 October 1990. In many cases, it authorized a "combat" TBO for use in Desert Shield, thus extending parts life under the prevailing conditions. Changes and updates to maintenance procedures are of little use without the required parts, consumables, and tools. Our provisioning experts have been working closely with publications personnel to evaluate environmentally induced problems and making appropriate changes.

High aircraft-readiness rates required in combat have resulted in a review of the aircraft phase inspection requirements. Our purpose has been to reduce phase maintenance inspection times in combat. We have reevaluated the phase maintenance inspection manuals on the prime aircraft systems.

Many of the existing inspection requirements were intended to add years to the life of the aircraft. When individual inspections are not required for readiness or safety, they are waived until the next phase. We have modified the phase inspection manuals for all first-line aircraft to reflect combat inspection requirements.

Sand erosion of rotor blades has resulted in the release of TB 1-1500-200-20-28, *Rotor Blade Erosion Protection for all Army Aircraft*, covering both painting and taping of rotor blades as shown in this extract from the TB (figure). We made changes to the provisioning of the UH-60 Black Hawk main rotor blade to permit the desert use of blades with inoperative deicing boots not required in Southwest Asia.

Based on field comments, we are currently preparing manuals for desert operation of the T700 and other engines. We have reduced lead time for the preparation of these manuals from months to days. We have expedited the preparation of many other manuals already being prepared. AVSCOM has released over 160 new and changed publications since 2 August 1990.

Behind the scenes, we have been working with the U.S. Army Printing and Publications Command, Alexandria, VA, to expedite delivery of technical manuals. The many lessons learned in dealing with different cultures and in transportation to and around this part of the world are included in these manuals.

Desert Shield already has brought positive results. We have reviewed and adjusted our operational and maintenance concepts and again feel certain that we are able *to go anytime, anyplace* to support the mission of Army Aviation throughout the globe. Now we even wonder what lessons could be learned from a large deployment under arctic conditions.

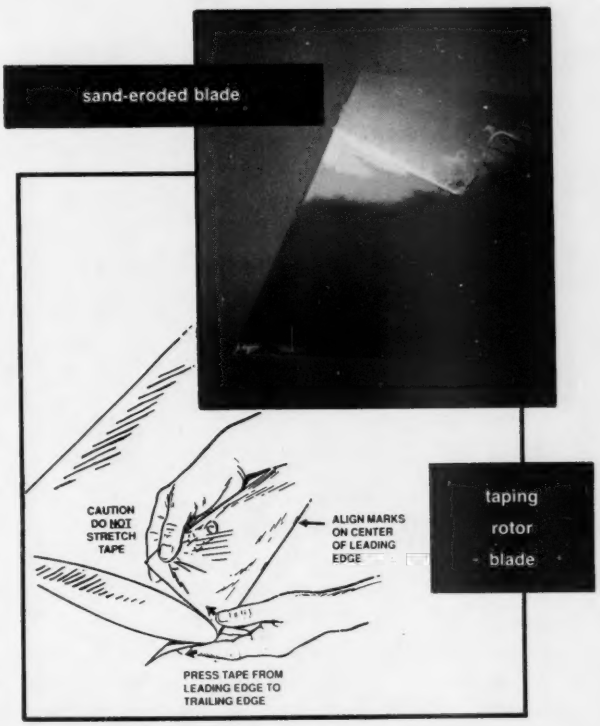

sand-eroded blade
taping rotor blade
CAUTION DO NOT STRETCH TAPE
ALIGN MARKS ON CENTER OF LEADING EDGE
PRESS TAPE FROM LEADING EDGE TO TRAILING EDGE

photo by the 49th PAD

Providing Engineering Support to Operation Desert Shield

Mr. William S. McDonald
Chief, Maintenance Engineering Division
Directorate for Maintenance
U.S. Army Aviation Systems Command
St. Louis, MO

DIRECTED BY Major General (MG) Donald R. Williamson, Commander, U.S. Army Aviation Systems Command (AVSCOM), and Colonel Gary D. Johnson, Director of Maintenance, business as usual ceased at 4800 Goodfellow Boulevard, St. Louis, MO, on 2 August 1990. Since that date, the Maintenance Engineering Division alone has deployed five personnel in theater. As forces build, support personnel requirements will expand.

Onsite Engineering

The need for onsite maintenance engineering expertise is now being met with three maintenance liaison engineers. The running joke is that they are on a half-day schedule of 12 hours daily. This is

close, but, in reality, their schedule is more in the 14- to 15-hour range. Major concerns have been the environmental effects on blades of the main/tail rotors and engine discs. Solving problems for acceptable criteria for both blade types has been extremely challenging. Another area of support has included the inspection of damage incurred during shipment of aviation assets to the theater.

With the Theater Aviation Maintenance Program—Saudi Arabia (TAMP-SA), most damage from deployment has been corrected successfully in theater. The presence of liaison personnel has allowed for rapid preparation of estimated cost of damages (ECOD). Based on these ECODs, repair/overhaul decisions can be made in a timely manner. By shrinking administrative time, Army Aviation *readiness state* for Operation Desert Shield has been greatly enhanced.

Maintenance Shelters

Providing onsite engineering support is important. The need for adequate shelter in which to perform maintenance is equally important. Deployed Army Aviation units were initially at a great disadvantage when performing maintenance in some of the harshest environments known. AVSCOM responded to the units' needs by furnishing maintenance shelters, in the initial stages of deployment. The shelters have these impressive features:

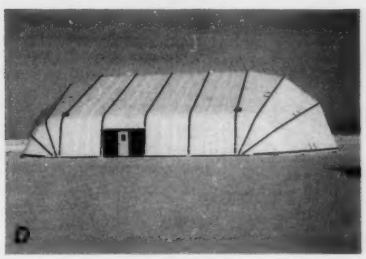
- Dimensions of 78 feet by 180 feet with a clear span and access from either end.
- A shelter center height, in excess of 30 feet, that can house 2 fully assembled CH-47 Chinook helicopters.
- A design that allows emplacement without the need for any type of construction boom with 95 percent of assembly occurring with personnel at ground level.

By the end of December 1990, no fewer than 44 of these shelters will have been emplaced. Personnel from the AVSCOM Maintenance Engineering Division are guiding the erection of the new shelters.

The efforts of the liaison maintenance engineers and personnel supervising the emplacement of maintenance shelters are the most prominent evidence of AVSCOM Maintenance Engineering Division's dedication to Operation Desert Shield. The not-so-apparent support efforts are those necessary to keep the logistics base alive and well. These

A view of the erection sequence for the new maintenance shelter:

A: The 4-man crew arrive on site to erect a clam-shelter, which will be 7,000 square feet (700 square meters).
B: After anchoring bases and assembling arches, the crew raise the arches, shear the cables, and install the horizontal supports for the roof.
C: The crew then install weathershell panel and liners from ground level.
D: After 2 days, the crew complete the structure.



efforts concern sustaining and controlling the technical base required to—

- Let and maintain contracts.
- Verify technical documentation for installation/maintenance of equipment modifications and mission kits.
- Identify improvements to field maintenance equipment and procedures.

To keep the technical base current, contractual action necessary to process modifications has been cut from 30 days to 3 days. *By no means can any one entity within AVSCOM take full credit for this accomplishment.* Few changes do not impact everything from item detail drawings to part numbers; thus, every functional element within AVSCOM has taken part in, and recognized the urgency of, actions stamped Operation Desert Shield.

Faster and Better

To assist the AVSCOM Maintenance Provisioning and Technical Publications Division, engineering support has been provided for concurrent design and verification of special mission kits. Review processes that normally have taken months are now being performed as prototype kits are designed. Rotor blade erosion kits are only one such example. As in the contract modification process, this is also a team effort within the Directorate for Maintenance and AVSCOM.

There are many examples of efforts to improve field maintenance and procedures; however, those that will benefit the deployed units most immediately are a combat phase maintenance checklist and an engine analyzer for use on aircraft.

At the start of Desert Shield, the AVSCOM commander recognized the need to provide the field commander with the ability to shorten scheduled major inspections to maximize combat availability. Based on his direction, the Maintenance Engineering Division coordinated efforts to produce modified phase maintenance inspection checklists for systems involved in Operation Desert Shield. These checklists comprise inspections of safety-of-flight items and warfighting systems. These checklists are designed for prudent use by the field commander. They are used during states of high-readiness requirements to enhance mission capability while ensuring system safety.

Introducing a large aviation contingent into the environmentally hostile operations area of Desert Shield has put an added challenge on the support agenda. This challenge is further increased by the stretched logistics lines of communications. A 4-year evaluation of a flightline engine diagnostic tool has shown both cost effectiveness and maintenance hour savings when used in troubleshooting T53 series engines.

Efforts are now underway to expand the capabilities of the contact engine analyzer to include T55, T700, and T63 engines. If all is successful, initial field use in Desert Shield will occur in the first quarter of 1991. Corpus Christi Army Depot, TX, personnel are now using the T53-capable analyzers.

Plans are to incorporate a contact engine tester with the new Flexible Engine Diagnostics System (FEDS). This will allow for data exchange and individual engine performance trending. The FEDS will be the next generation of engine test stands for

photo by Gil High, *SOLDIERS* Magazine

use at aviation unit maintenance and depot levels. By coodinating the two programs, performance and engine health data will be transferrable between levels of maintenance through automated media.

Theater Aviation Maintenance Program—Saudi Arabia (TAMP-SA)

Forward depot support for Army Aviation in Operation Desert Shield is in place and working. The Directorate of Maintenance is fully responsible for this AVSCOM forward element. This organization combines contractor personnel and AVSCOM maintenance personnel, both civilian and military. The Maintenance Engineering Division coordinated efforts by commodity commands other than AVSCOM to provide logistic support for aviation-related systems and subsystems.

The team approach has yielded a significant reduction in repair cycle time. Components are being repaired and returned to serviceable condition without leaving the theater. This approach, fostered initially in Europe, is being used to minimize the logistics pipeline and maximize Army Aviation combat readiness at a time and place where it is needed!

These efforts are a sample of the many challenges AVSCOM has met successfully since MG Williamson declared "no business as usual" for Desert Shield support. No one organization should be credited with any given success. The logistical success to date is a direct result of the cooperative team effort within AVSCOM, Directorate of Maintenance, and other commodity commands. Future support efforts toward Operation Desert Shield will succeed through the same team effort.

The Directorate of Maintenance, U.S. Army Aviation Systems Command (AVSCOM), is heavily committed to support of Army Aviation units deployed for Operation Desert Shield. A growing number of maintenance engineering hours are being expended on this operation.

LEFT: Soldiers of the 101st Airborne Division load HELLFIRE missiles on an AH-64 Apache at a port in Saudi Arabia.

BELOW: An OH-58D alongside of AH-64 Apaches on the flightline in Saudi Arabia.

BOTTOM: Army and Air Force work together to down-load this vehicle from a C-5 Galaxy.

photo by the 49th PAD

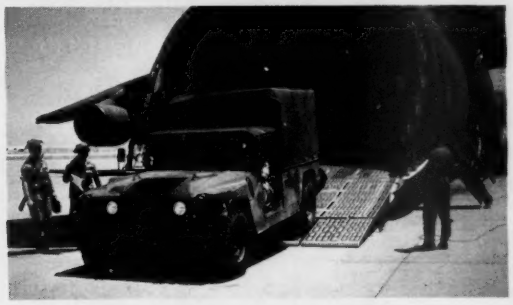


photo by Gil High

Readiness and Conservation, Partners in the Persian Gulf

Mr. William H. Arnett
Directorate for Maintenance
U.S. Army Aviation Systems Command
St. Louis, MO

SERVICE FROM the U.S. Army Aviation Systems Command (AVSCOM), St. Louis, MO, 2410 Hotline is expanding rapidly to Desert Shield units in the Persian Gulf. This Hotline is invaluable when your aircraft is grounded for lack of data on an installed component. Also, when you receive replacement components without necessary records telling you how much operating time is on the item, the Hotline can help.

Improved telephone communications to the National Maintenance Point (NMP) in St. Louis have allowed some units to call the Hotline direct for reconstruction of component historical data. When current and accurate 2410 information is available in the data base, it is then possible, in many instances, to prevent early or premature replacement or overhaul of a critical and expensive component. When this happens, resources are conserved with the potential for improved aircraft readiness, not to mention the benefits in safety and cost avoidance.

We handle all requests for 2410 information from Desert Shield as immediate first priority. Normally, we handle all requests for assistance on an expedited basis; however, *Desert Shield comes first.* Personnel manning the 2410 Hotline here at AVSCOM in St. Louis are on a 24-hour standby to take care of Desert Shield requirements. We also have a 24-hour answering service and we answer all calls the next day.

When you call, the following information helps us to speed up our research on the item and provide you a quick answer; therefore, please have this information available on the item: National stock number, part number, and serial number. If you have just received the item and it appears new, when possible, let us know the Contractor and Government Entity (CAGE) number or manufacturer's code (i.e., K97499), contract number, and if you received the item in the contractor's package.

With users' support during the last fiscal year (1990), cost avoidance derived from the 2410 Hotline alone amounted to $60.4 million. Together, we can continue to conserve these dollars and expensive resources to further our mission in the Persian Gulf. You may contact the 2410 Hotline by telephone or datafax, using these numbers: DSN 693-1879 or Commercial (314) 263-1879. The datafax number is DSN 693-2075 or Commercial (314) 263-2075.

The preceding information is brief and falls short of telling you what's going on in Desert Shield aviation maintenance. It does, however, indicate some of the ingredients needed to nurture this dynamic undertaking and how the NMP is contributing to the effort. The process will continue as long as necessary to fulfill our responsibilities in support of aviation maintenance in the Persian Gulf.

M-130 Flare/Chaff Dispenser

Questions may be directed to the point of contact, CW4 Robert G. Smithson, AUTOVON 558-4110, Ft. Rucker, AL.

A RECENT FIELD EXERCISE disclosed that soldiers did not know how to properly test, load, arm, and program the M-130 Chaff/Flare Dispenser. The M-130 Technical Manual (TM) 9-1095-206-13&P designated responsibility to the operator or crew to perform preflight or rearming tests and load the system. The TM did not specify a maintainer for aviation unit maintenance (AVUM) or aviation intermediate maintenance (AVIM).

In November 1988, a new technical manual, TM 9-1095-206-23&P, *Aviation Unit Maintenance and Aviation Intermediate Maintenance Manual for Dispenser, General Purpose Aircraft: M-130*, superseded the former TM. It designates the Military Occupational Specialty (MOS) 68J Aircraft Armament/Missile Repairer as the AVUM/AVIM maintainer; MOS 68N (35K) Avionics Mechanic as the AVUM maintainer in units not authorized 68J; and MOS 58R (35R) Avionics Radar Repairer for AVIM maintenance.

The new TM incorporates the preflight or rearming test and loading procedures into the aviation unit maintenance responsibilities. The operator tasks are outlined in the correct airframe -10 TMs.

The November 1988 manual was not sent out immediately. However, it is currently being fielded on automatic distribution, but also may be ordered through normal publication channels. The MOS requirements outlined in this manual are being revised. All units equipped with the M-130 should ensure they have this new TM.

The Directorate of Training and Doctrine (DOTD), Ft. Rucker, AL, fielded a handbook on how to test, load, arm, and program the M-130 Dispenser System. The handbook has been distributed to all units with the M-130 system. Users may get a copy from Aircraft Survivability Training Management, DOTD, United States Army Aviation Center (USAAVNC), Ft. Rucker, AL, 36362.

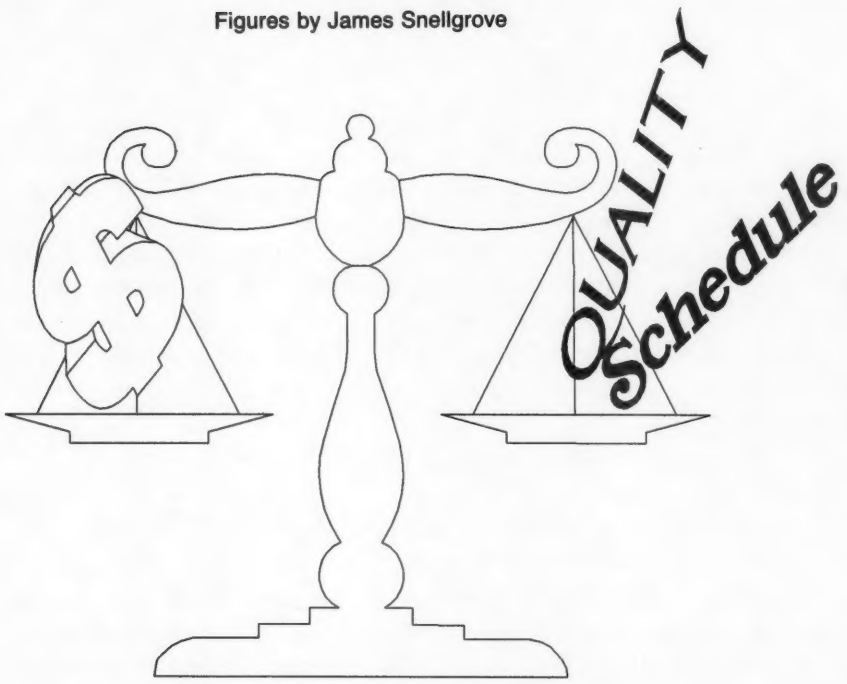
The U.S. Army Aviation Center has been working to field a chaff training round. This training round will greatly enhance sustainment training in units equipped with the M-130 system. Users can use a chaff training round with no adverse environmental restrictions at any home station. The 2,000 rounds already produced will be fielded to deployable units for testing and training.

The fielding of Aircraft Survivability Equipment Trainers (ASET) II allows crews to use ASE as they would in an actual combat mission. The ASET II will enable the operator or crew to operate and program the M-130 System according to currect doctrine. ASET II simulation provides the crews with an immediate indication of correct or incorrect employment of ASE.

ASET II was fielded in January 1991. An interim package for Saudi Arabia was fielded in December 1990.

Lieutenant Colonel W. Larry Dandridge
Chief, Aircraft Logistics Support
U.S. Army Aviation Center
Fort Rucker, AL

Figures by James Snellgrove



U.S. Army Aviation Center

Aircraft Maintenance Contract

THIS ARTICLE discusses the Fort Rucker, AL, aircraft maintenance contract. This Cost Plus Multiple Incentive Fee (CPMIF) contract is operating efficiently and effectively. It has consistently met the U.S. Army Aviation Center (USAAVNC) training requirements, cost control needs, and quality standards for 35 years. (The one exception was for the AH-64 Apache between January and October 1987.) Parts substitution (lateral exchange) is highly controlled and wisely managed, and deferred maintenance is minimal. (Lateral exchanges average less than four per 750- aircraft launch day.)

The USAAVNC fleet averages less than two deferred maintenance writeups per aircraft. (The contractor is penalized if deferred maintenance is more than 3 days old.) Most impressive is the fact that Fort

Rucker flies about one-fourth of the total Army flight hours—with only 6 to 7 percent of the Army fleet—while consuming approximately 10 percent of the Army's aviation repair parts. Over the past years, these facts have been verified by numerous external agencies and most recently reconfirmed by the U.S. Army Audit Agency (USAAA) in December 1988 and January 1989.

Contract History, Mission, and Description

DynCorp has been the Fort Rucker aircraft maintenance contractor since October 1988. Sikorsky Support Services, Incorporated; Northrop; Paige; Hayes; Aeronca; and Spartan were previous contractors. The Fort Rucker aircraft maintenance contractor supports the largest flying hour program in the U.S. Army. Fiscal year (FY) 1990 flying hours were 393,270. Besides the maintenance manhours expended to support these flying hours, 319,715 maintenance manhours were expended to support modification work orders (MWOs) and satellite customers including—

- U.S. Army Aeromedical Research Laboratory
- U.S. Army Aeromedical Center
- 2/229th Aviation Regiment
- Aviation Branch Safety Office
- U.S. Air Force
- U.S. Customs
- U.S. Army Aviation Museum
- U.S. Naval Coastal Systems Center
- Fort Benning, GA
- Transient aircraft
- National Oceanic and Atmospheric Agency
- Directorate of Enlisted Training, USAAVNC
- U.S. Army Aviation Technical Test Center (USAATTC). (Of the 319,715 maintenance manhours, 306,485 supported USAATTC)

The aircraft maintenance contractor provides aviation unit maintenance, aviation intermediate maintenance, and limited depot maintenance support to Fort Rucker. The Aircraft Logistics Management Division (ALMD) at Fort Rucker measures aircraft availability performance four times daily at each launch (two during the day and two at night). Quality is assured through the contractor's quality control system, the government's surveillance inspection program (ALMD, Defense Contract Audit Agency, and the contracting officer), and pilot inspections.

The contract requires the contractor to provide the number of mission-capable aircraft required to train at each launch or a percentage (normally higher than the training requirement), whichever is less. However, no real ceiling exists on availability because the contractor has a natural incentive to provide as many aircraft as the government needs despite the percentage. More aircraft flying hours mean reduced maintenance manhour cost and also more opportunities for contractor profit/fee.

Currently, the contract supports over 700 aircraft (564 U.S. Army Aviation School, 14 USAAVNC, and over 100 satellite customers). It also supports many special projects like the Apache Action Team and the Apache Area Weapon Systems Review Board. Contract maintenance provides Fort Rucker with highly qualified and stable aircraft maintenance support.

The average age of Fort Rucker's maintenance employees is around 47 years. The average experience level is approximately 17 years. Most of the contractor employees are journeymen. Most mechanics have an airframe and power plant license or other equivalent certification. All ALMD government inspectors are journeyman-level employees. The government provides all equipment (over $24 million in industrial property) except for the individual mechanic's handtools.

Aircraft Maintenance Contract

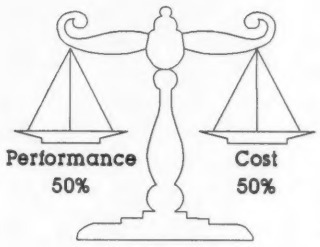


FIGURE 1: Balanced, objective incentives.

Cost fee formula provides for "objective" increases in fee above target fee when total allowable costs are less than target cost, and "objective" decreases in fee below target fee when total allowable costs exceed target costs.

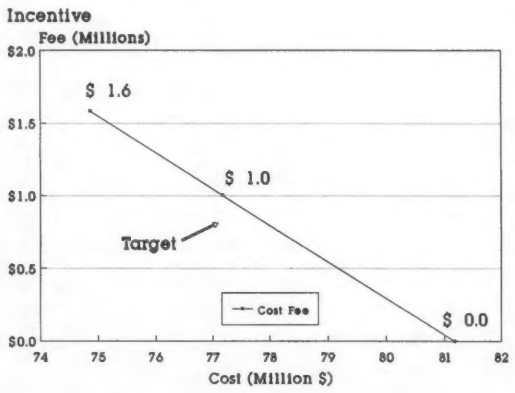


FIGURE 2: Cost incentive structure, FY 1990.

Minimum Cost : $74,853,280
Target Cost : $77,168,328
Maximum Cost : $81,181,080

The Fort Rucker aircraft maintenance contract places equal importance on performance (aircraft availability, quality, supply management, etc.) and cost control.

Multiple Incentives

The aircraft maintenance contract emphasizes aircraft safety, availability, supply support, quality, and cost control as bases for incentive fee. The government considers that the total incentive fee (profit) pool should be divided between cost and performance in two relatively equal parts.

The Fort Rucker maintenance contract includes a cost incentive fee and a performance incentive fee formula (figures 1 and 2). Cost incentive fee is based on provision for a fee adjusted by contract formula in accordance with the relationship that the total allowable cost bears on the target cost. The formula provides, within limits, for increases in fee above target fee when total allowable costs are less than target cost; it provides a decrease in fee below target fee when total allowable costs exceed target costs.

Performance Incentive. Performance incentive fee is based on a balancing of availability of aircraft, quality, and supply support management. Performance that is the minimum the government will accept is mandatory. Performance that surpasses the stated targets will be rewarded by additional fee (profit). The performance incentive feature (providing for increases or decreases as appropriate) is applied to performance targets

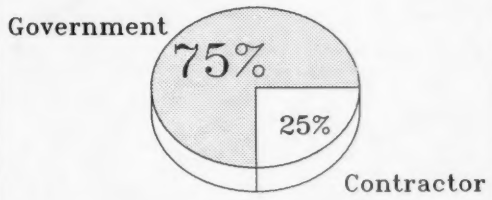


FIGURE 3: Share ratio: Overruns and underruns.

The contract makes maximum use of the market economy's profit motive by rewarding the contractor with 25 cents of every dollar saved below target.

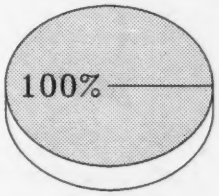


FIGURE 4: Quality impacts all fees.

Quality (Accident Prevention) impacts all fees. Lack of quality can cost the contractor as much as l00 percent of all performance and cost fees. If the contractor fails one of the 26 major quality inspections, the contractor is penalized any availability performance fee he earns above 100 percent for that 2-week period. If aircraft availability falls below 90 percent, the contractor not only loses performance fee but also cost fee. If the contractor fails three consecutive quality inspections, the contractor loses 1/26 of his cost fee. Also, if the aircraft fails a pilot or ALMD launch inspection, the contractor loses availability fee for that aircraft for that launch.

rather than performance requirements (figure 3).

Aircraft Availability (Maintenance) Incentive. For the maintenance performance fee an *acceptable quality of maintenance* (figure 4) is required before any positive performance incentive fee can be earned on *availability*. For availability of aircraft, the government has established 100 percent as the desired number (target) for training requirements. The contractor receives positive (+) incentive fee (profit) from 100 percent to 110 percent and negative (-) incentive fee for 90 percent to 100 percent (figure 5).

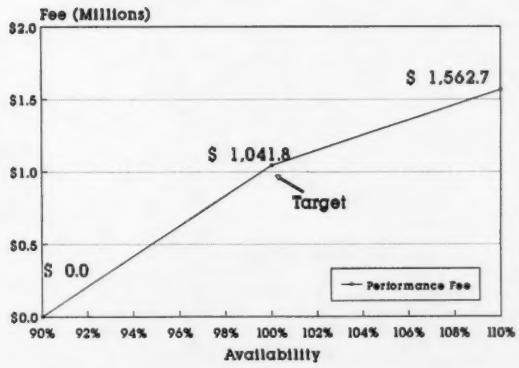


FIGURE 5: Availability incentive structure, FY 1990.

Target availability is 100 percent. Availability from 90 percent to 100 percent is twice as important as availability from 100 percent to 110 percent. Aircraft availability (performance) is incentivized to ensure 100 percent of all training requirements are met.

Aircraft Maintenance Contract

FIGURE 6: Total incentive structure, FY 1990.

The Cost Plus Multiple Incentive Fee (CPMIF) contract is an *objective* formula for determining profit. This figure outlines the FY 1990 incentive structure and shows a cost incentive fee pool of about 1.3 percent and a performance incentive fee pool of about 1.5 percent of total contract cost. There was a ceiling of 4.3 percent on the fee in the FY 1990 contract.

	TARGET	MAXIMUM
Availability Incentive Fee	$ 1,041,773	$1,562,658
Supply Incentive Fee	+115,752	+173,629
Performance Incentive Fee	1,157,525	1,736,287
Cost Incentive Fee	+1,003,188	1,581,950
Estimated Incentive Fee	2,160,713	
Estimated Target Fee	+77,168,328	
Total Estimated Contract Cost	$ 79,329,041	

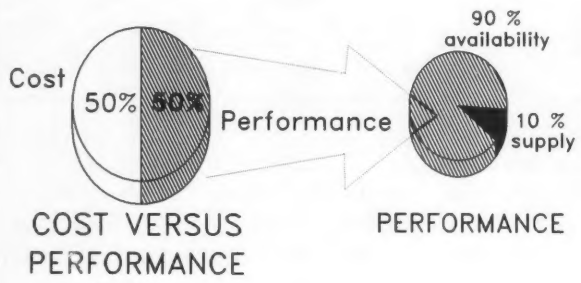
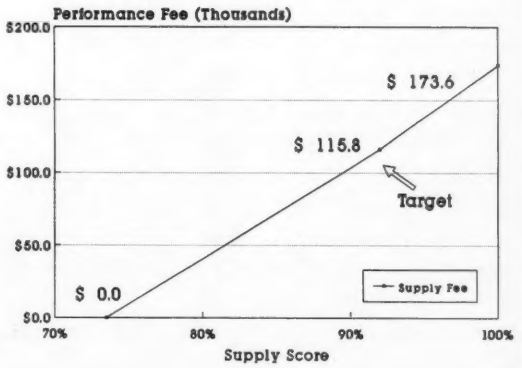


FIGURE 7: Supply incentive structure: Cost and performance.

Ten percent of the performance fee pool is reserved for rewarding or penalizing supply performance.

FIGURE 8: Supply incentive structure, FY 1990.

Minimum Acceptable Supply: 73.5 percent.
Target Supply: 92.0 percent.
Maximum Supply: 100.0 percent.
Under the supply incentive structure, each area is "objectively" measured quarterly. Scores are weighed in order of relative importance. Scores on each area are summed to arrive at supply incentive score. Target performance score is 92. No fee is awarded for scores below 73.5. The supply incentive is a relatively new feature of the contract.



The maximum number of aircraft the contractor may designate as available for any period by aircraft type and location is 110 percent required for that type aircraft and location. Within the availability fee (profit), 90 percent to 100 percent has been determined to be twice as important as availability of 100 percent to 110 percent. That is, the contractor loses double the amount at 99 percent that he would earn at 101 percent. Below 90 percent, the contractor is not only at "0" performance fee, he also is not entitled to any cost incentive fee earned for that 2-week period (training cycle). The fee (profit) motivation ensures a sufficient number of flyable quality aircraft for training (figure 6).

Ten percent of the performance fee pool is reserved for rewarding or penalizing supply performance (figure 7). Supply performance is measured by the Defense Federal Acquisition Regulations Supplement 3 System surveys in the five areas: Excess, inventory adjustments, assets returns, due-ins from maintenance, and assets installation (Account 87).

Each area is measured quarterly and scores are weighed in order of relative importance. Scores on each area are summed to arrive at the supply incentive score. No fee (profit) is given for a supply incentive score below 73.5 (figure 8).

Quality Impacts All Fees

Accident prevention (quality) is the number one priority at USAAVNC. The government (ALMD) uses a quality surveillance inspection program to determine the quality of contractor maintenance. This system is based on the "random sample" selection technique outlined in Military Standard (MIL-STD)-1050 (currently on a micro-computer program in ALMD). One general inspection of the total USAAVNC fleet is conducted each 2 weeks from the start of the fiscal year for a total of 26 inspections.

In accordance with MIL-STD-1050, the government randomly determines (by the ALMD computer program) the following:

- The day on which the inspection will be conducted.
- The quantity (lot size) of aircraft at each airfield to be inspected is 80 based on MIL-STD-1050 and the current fleet size.
- The specific tail numbers of the aircraft to be inspected at each airfield.

In determining the acceptability criteria for any aircraft during these 26 no-notice and random quality inspections, a critical fault (Red X condition) will always cause the aircraft to be unacceptable because it places the aircraft in an inoperable status. Neither red diagonals (/) (nongrounding faults) nor red dashes (-) (overdue inspections, checks, test flights, replacements, and modifications), in any quantity, place an aircraft in an inoperable status. However, the government has determined a maximum shortcoming limit; the aircraft is considered unacceptable for quality purposes if it exceeds this limit. For example, the maximum number of allowable shortcomings for quality inspection purposes on a UH-1 Huey or OH-58A or C Kiowa is five. (For quality inspection purposes, the largest period of time a dash or diagonal can stay on an aircraft at USAAVNC is 3 days. This is true unless the reason the fault has not been corrected is the government's.)

To pass each quality inspection, the contractor must have at least 73 aircraft pass the inspection. In other words, no more than 7 (9 percent) of the 80 aircraft inspected can fail to obtain an overall satisfactory result. By the way, should the contractor fail two quality inspections in a row, he is put into a tightened inspection criteria (meaning failing now becomes six aircraft instead of eight); he must pass five consecutive quality inspections to come out of tightened inspection criteria status.

Aircraft Maintenance Contract

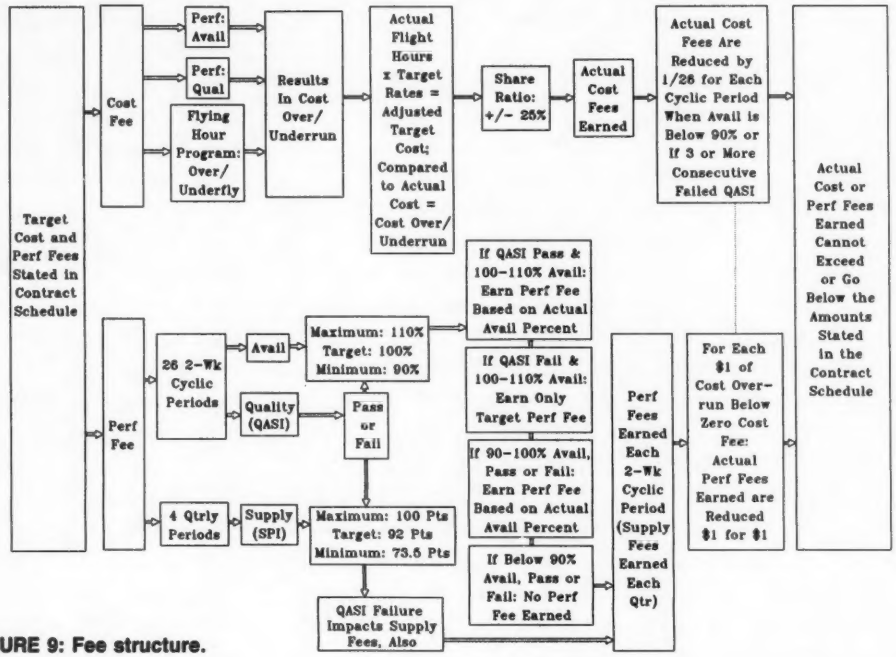

Target Cost and Perf Fees Stated in Contract Schedule
Cost Fee
Perf: Avail
Perf: Qual
Flying Hour Program: Over/ Underfly
Results In Cost Over/ Underrun
Actual Flight Hours x Target Rates = Adjusted Target Cost; Compared to Actual Cost = Cost Over/ Underrun
Share Ratio: +/- 25%
Actual Cost Fees Earned
Actual Cost Fees Are Reduced by 1/26 for Each Cyclic Period When Avail is Below 90% or If 3 or More Consecutive Failed QASI
Actual Cost or Perf Fees Earned Cannot Exceed or Go Below the Amounts Stated in the Contract Schedule
Perf Fee
26 2-Wk Cyclic Periods
Avail
Maximum: 110% Target: 100% Minimum: 90%
Quality (QASI)
Pass or Fail
4 Qtrly Periods
Supply (SPI)
Maximum: 100 Pts Target: 92 Pts Minimum: 73.5 Pts
QASI Failure Impacts Supply Fees, Also
If QASI Pass & 100-110% Avail: Earn Perf Fee Based on Actual Avail Percent
If QASI Fail & 100-110% Avail: Earn Only Target Perf Fee
If 90-100% Avail, Pass or Fail: Earn Perf Fee Based on Actual Avail Percent
If Below 90% Avail, Pass or Fail: No Perf Fee Earned
Perf Fees Earned Each 2-Wk Cyclic Period (Supply Fees Earned Each Qtr)
For Each $1 of Cost Over-run Below Zero Cost Fee: Actual Perf Fees Earned are Reduced $1 for $1

FIGURE 9: Fee structure.

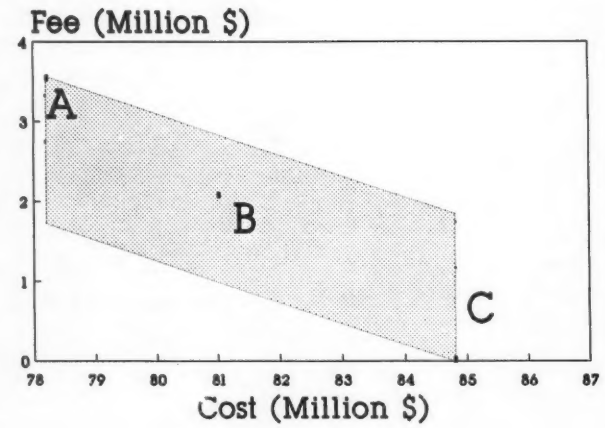


FIGURE 10: FY 1990 range of incentive effectiveness.

Figure 9 outlines how the Fort Rucker aircraft maintenance contract takes advantage of the invisible hand of our market system to ensure high quality, satisfactory supply management,aircraft availability, and cost control. The CPMIF features of this contract check and balance the government's and contractor's sometimes competing goals to ensure all of Fort Rucker's priorities are satified. These goals are quality, availability, supply, maintenance, accident prevention, environmental protection, security, and cost.

The Fort Rucker contract provides a "range of incentive

effectiveness" (figure 10). In principle, if the contractor performs anywhere in the shaded area in figure 10 (the range of incentive effectiveness), the contractor will have provided satisfactory performance. Point A represents an area of highest government satisfaction. (The contractor is meeting 110 percent of aircraft training requirements, making 100 on all supply inspections, and doing high-quality work at the lowest cost imagined.) Point B represents the area where most contractors have operated in the past. Point C represents the least satisfactory performance that incentives will be paid. In principle, any operation above Point C (above $84.9 million) would be unacceptable to the government.

Programmed Realtime Information System for Management

The contractor manages the Fort Rucker aircraft maintenance and supply system through the government-owned Programmed Realtime Information System for Management (PRISM). Previous contractors developed this system to provide fast, accurate, and automated supply, accounting, maintenance, personnel, and information management of Fort Rucker's maintenance mission. The system is described as "the Army's only realtime fully automated retail supply management system." It supports an authorized stockage level (ASL) of approximately 15,000 lines. (This includes about 5,000 AVSCOM items and around 10,000 other commodity command items.)

To augment the ASL, the contractor has established a bench stock for each of the four maintenance bases (Cairns, Lowe, Hanchey, and Shell) and the Aircraft Maintenance Support Shops. A welcomed addition to Fort Rucker's supply support is the 2,496 lines from the U.S. Army Materiel Command's forward distribution point, which opened 4 January 1988. The value of this stock is around $4.2 million.

The contractor is provided government-furnished repair parts and property to perform his mission (figure ll). During FY 1988 and FY 1989, Ft. Rucker received and issued repair parts as shown in figure 12, which also depicts the average serviceable inventory and turnover rates for the 2 fiscal years. Figure 13 shows the total number of requisitions for repair for the same 2 years. Total contracts costs for FY 1987 through FY 1990 are shown in figure 14.

Supply Contract Benefits

The following is a partial list of the significant supply benefits USAAVNC and satellite customers reap from the Fort Rucker aircraft maintenance contract:

- Overall aircraft availability runs around 105 percent of requirements.
- Controlled exchange (radios not included) averages less than 104 a month. (This number has doubled because of the Middle East crisis in

FIGURE 11: Government-furnished repair parts (including all orders) and property data as of 21 September 1990.

	LINE ITEMS	VALUE
AVSCOM	*8,766	$22,289,676.09
Other AMC commodity commands, Defense Logistics Agency, General Services Administration*	28,594	6,787,638.05
Industrial property	+ 4,540	+ 24,840,312.19
Total	41,900	$53,917,626.33

*(Includes all orders) (Fringe)

Aircraft Maintenance Contract

	AVSCOM Procurement Army funded	AVSCOM stock funded
FY 1988 Fort Rucker received repair parts Includes depot receipts, turn-ins, price changes, and fund code increases.	$ 396.5	$ 46.9
FY 1989 Fort Rucker received repair parts Includes depot receipts, turn-ins, price changes, and fund code increases.	$ 332.2	$ 35.6
FY 1988 Fort Rucker issued repair parts Includes depot shipments, Defense Utilization and Marketing Office price changes, fund code decreases.	$ 391.5	$ 46.2
FY 1989 Fort Rucker issued repair parts Includes depot shipments, Defense Utilization and Marketing Office price changes, fund code decreases.	$ 324.4	$ 34.9
FY 1988 average serviceable inventory	$ 11.7	$ 4.6
FY 1989 average serviceable inventory	$ 17.4	$ 5.3
FY 1988 turnover rate	19.0	6.0
FY 1989 turnover rate	18.6	6.6

FIGURE 12: Repair parts and inventory (in millions of dollars).

	FY 1988	FY 1989
AVSCOM	27,528	32,208
other commodity commands	49,893	33,274

FIGURE 13: Total requisitions submitted for repair.

FY 1987	$ 97,363,988
FY 1988	$ 91,626,486
FY 1989	$ 88,984,863
FY 1990	$ 90,302,601

FIGURE 14: Total contract costs.

September and October 1990.)

- Demand satisfaction (ASL depth) is about 78 percent. (The goal is 75 percent.)
- Demand accommodation (ASL width) is about 94 percent. (The goal is 80 percent.)
- Stock availability (fill rate) runs around 76 percent. (The goal is 70 percent.)
- Zero balance averages about 6.4 percent. (The goal is less than 8 percent.)
- Inventory accuracy runs over 99 percent. (The goal is 95 percent.)
- Receipt processing time takes from 2 hours to 2 days. (The goal is less than 3 days.)
- Request processing time runs about 2 hours. (The goal is less than 2 days.)

Other Contract Benefits

Accounting, personnel management, maintenance management, and supply management is highly automated and accurate. (Most experts agree that USAAVNC maintenance manhours per flight hour rates are the most accurate portrayal of maintenance effort in the Army.) Accident prevention, hazardous material handling, and environmental protection programs are very advanced and effective. (Personal injury and property damage rates are the lowest ever.) Fort Rucker submits from 3,000 to 5,000 high-quality QDRs (quality deficiency reports) annually.

A Model for Other Contracts

The Department of Defense Inspector General reviewed the USAAVNC aircraft maintenance contract in late 1989 and stated in a memorandum to the commander of another training organization:

"The use of incentives on maintenance contracts is reasonable; however, the incentives should be based on factors that indicate the quality of maintenance, aircraft performance, and cost. Fort Rucker uses a cost type contract with provisions tied to specific quality of maintenance factors, aircraft performance factors, and cost provisions. We believe the Fort Rucker contract is an effective contract and could be used as a model for structuring contract provisions by (others)."

Summary and Future

For over 16 years Fort Rucker's aircraft maintenance contract has proven that the CMIF concept provides the flexibility, stability, performance, cost control, quality, and accident prevention required by USAAVNC and satellite customers. Considering the growth of Fort Rucker's aircraft maintenance and supply mission, the cost of the maintenance contract has been kept to a minimum ($90.3 million in FY 1990).

Because of the uncertainties involved, the scope of the contract cannot be determined to the degree of reasonableness required for a fixed-price contract. These uncertainties include worldwide developments, curriculum changes, weather, changes in quantities and types of aircraft, and parts availability.

This contract is not perfect, but it is operating effectively. It may be useful to other agencies as a model for service contracts (especially the incentives, checks and balances, and quality standards). The contract was competed in 1988 to help control costs and resulted in FY 1989 estimated savings of $8 million. Fiscal year 1990 was an even better year for aircraft maintenance at Fort Rucker.

In January 1989, USAAA recommended that Fort Rucker pursue a cost transfer study to determine if aircraft maintenance can be done less expensively in-house. Even though the transfer study has been put on hold because of the encouraging cost performances in FY 1988, FY 1989, and FY 1990, it is logical to assume that the government will compete for the contract at some time in the future. If you have any questions about the contract, you can call the Aircraft Logistics Management Division at AUTOVON 558-5700/3849, Commercial (205) 255-5700/3849, or FAX (205) 255-3717.

PEARL'S

Personal Equipment And Rescue/survival Lowdown

Sand, Sun, and Survival

Army National Guard (ARNG) soldier aircrews will again have the opportunity to "sweat-it-out" during hot climate aviation survival training. The Arizona ARNG Western Aviation Training Site and adjacent training area are located in the Sonoran Desert. This desert survival aircrew training is considered the best of its kind in the United States.

The purpose of the course is to provide hot climate combat survival training for aircrew and nonaircrew personnel. These personnel must participate in regular and frequent flights in a desert environment.

Combat aircrew survival training provides training for use of on-board aviation life support equipment (ALSE). This training also provides practical techniques for on-the-ground survival in a desert environment and how to stay alive until rescued.

Users may obtain registration information in Field Manual 1-508, *Maintaining Aviation Life Support Equipment: Maintenance Program*, page 8-8. Users may also phone the Western Region Aviation Survival School, Commercial 503 636-6254. This school has FY 1991 training schedule data and student information booklets.

Western Region ALSE/Survival School

These remaining fiscal year (FY) 1991 classes are scheduled at the Western Region ALSE/Survival School:

Hot climate survival classes, conducted at the Western Aviation Training Facility, Marana, AZ, are as follows: 21-26 Apr, 28 Apr-3 May, 16-21 Jun, 23-28 Jun, 7-12 Jul, 4-9 Aug, and 11-16 Aug.

Other classes, conducted near Portland, OR, are as follows: 2-5 Jun, Overwater Survival; 2-9 Aug, ALSE Orientation Survival Course; 8-13 Sep, Basic Land Survival; and 15-27 Sep, Survival Instructor Course (Land).

ALSE orientation courses are not skill qualification identifier-producing courses. Instead, these 2-day, hands-on orientation classes are intended to prepare the student for the regular 5-week course at Ft. Eustis, VA. ALSE officers become survival students on the Mondays of their scheduled weeks.

ALSE Shops

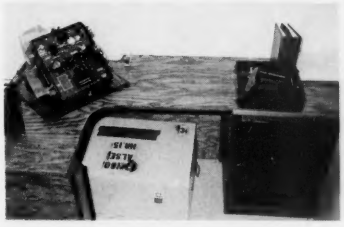
PEARL'S HAD THE PLEASURE of visiting one of the newest, and so far the best, ALSE shops we've seen in the Active Army. This new custom-built facility opened in August 1990. It belongs to the 3d Battalion, 160th Aviation Regiment, Hunter Army Airfield, GA.

Seven soldiers of the 3d Battalion invested more than 800 hours each of their off-duty or leave time to build this ALSE shop from scratch. The project was headed by Sergeant First Class (SFC) Harold Freeman, ALSE noncommissioned officer in charge (NCOIC); Specialist (SPC) Brian Jackson, flotation shop supervisor, architect, and draftsman; Staff Sergeant Joe Cabera who will replace SFC Freeman as NCOIC; SPC Rick Kohler; Private First Class (PFC) David Beckly; PFC Douglas Alder; and PFC Douglas Bagby. These individuals have done a remarkable job of planning and constructing this facility. It comprises a storage and issue room for aircrew ALSE; an inspection, maintenance, and fitting room with an administration area; a night vision device test room; plus office space for the ALSE officer. Also, a large flotation shop is located in another building to maintain the 64 life rafts needed by the battalion for their mission and training requirements.

The maintenance and fitting room has a combination inspection and workstation for each item of ALSE; i.e., survival vests, flight helmets, life preservers, first aid kits, and helicopter emergency escape devices (HEEDs). This unit takes overwater flights and survival training seriously. All elements

3d Battalion ALSE maintenance and fitting room showing the vest work station at left along the wall; a central oval work table with tech manuals and forms shelves; and the helmet workstation in the corner.

An ALSE technician works on a flight helmet in the helmet work station.



The night vision devices test room with the Aviator Night Vision Imaging System tester.

The oval work table showing the built-in shelves for inspection and maintenance forms.

The medical work area is for first aid kits and helicopter emergency escape devices.

of the 160th Aviation Regiment are required to complete U.S. Navy helicopter overwater survival training plus the Survival, Escape, Evasion, and Resistance Course at Ft. Bragg, NC.

Other Army Aviation units are serious about ALSE and survival training. How serious is your unit? Do you have the correct ALSE on hand to meet and support your mission? How about sending PEARL'S a run down on how your shop is organized. If possible, include some black and white photos of your ALSE shop. Remember, it's not the size of your shop that matters, but how you have organized and equipped it to support your mission requirements.

If you have a question about personal equipment or rescue/survival gear, write PEARL'S AMC Product Management Office, ATTN: AMCPM-ALSE, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798 or call AUTOVON 693-3573 or Commercial 314-263-3573.

AVIATION MEDICINE REPORT
Office of the Aviation Medicine Consultant

FACE OF DEATH

First Lieutenant G. Habermehl
5-158 Aviation Regiment, U.S. Army
Frankfurt, West Germany

Military personnel are trained to fight and, if necessary, die for their country. Yet, most people probably never have thought about facing a life-threatening situation. Dying is not openly discussed in our society. People aren't reared to deal with it. Nevertheless, we never know when we may confront the face of death.

WHAT STARTED as a routine mission turned into something warrant officers Mike Brookins and Rich Phillips will never forget. They, as Army aviators stationed in Frankfurt, West Germany, were assigned to fly cover ship for a convoy returning from a field training exercise near Giessen. An urgent message came over the radio as the aircraft arrived on station. An armored personnel carrier had

rolled over and crushed its commander. The soldier was badly injured and required immediate evacuation.

Army helicopters that are not equipped for medical evacuation (MEDEVAC) may not be used for emergency evacuation unless the situation is life threatening. Knowing this, they accepted the mission and flew to the accident site. The injured soldier died as he was being loaded into the aircraft. He was evacuated to 97th General Hospital, Frankfurt, where he was pronounced dead.

This tragedy came as a shock to both men because neither had ever seen the "face of death." After the mission, they felt extremely somber. Both WO Brookins and WO Phillips said they weren't prepared for what took place and it was depressing to see someone die.

How do people learn to face death? Captain (CPT) Bill Grimes, a MEDEVAC pilot stationed at Nellingen Army Heliport, Stuttgart, believes that training can't really prepare you for such a situation. MEDEVAC pilots may be required to face death on a daily basis. CPT Grimes emphasized that a MEDEVAC pilot has a specific job to do. He may be aware of what is happening in the back of the helicopter, but must detach himself from it and concentrate on flying. Only after his job is finished does the pilot follow the progress of the passengers.

MEDEVAC pilots take great pride in knowing they make a difference. Aircraft manufacturers award these pilots with a rescue pin signifying success in a life or death situation.

Chief Warrant Officer Karl Kupfer, also stationed in Frankfurt, was a MEDEVAC pilot in Vietnam. Asked how seeing death during war affected him, he replied:

"Seeing death bothers you at first, but when you see it on a daily basis, it is like a circuit breaker goes off in your head. The bodies cease to be human and become packages. I know it sounds cold, but that is the only way to cope with it in war. I went to a 2-week training course at Ft. Sam Houston, TX, before deploying to Vietnam. They talked about death, but I don't think anything can really prepare you for coming face to face with it. You never get used to seeing death. The best you can do is learn to live with it."

The Aviation Medicine Report is a bimonthly report from the Aviation Medicine Consultant of TSG. Please forward subject matter of current aeromedical importance for editorial consideration to U.S. Army Aeromedical Center, ATTN: HSXY-ADJ, Fort Rucker, AL 36362-5333.

U.S. Army Class A Aviation Flight Mishaps

	Number	Flying Hours	Rate	Army Fatalities	Total Cost (in millions)
FY 90 (through 31 January)	11	479,139	2.30	11	$53.1
FY 91 (through 31 January)	17	441,018*	3.85	12	$49.6

*estimated

OPERATIONS IN

We fought (and died) the way we trained

DATE: June 1991.

PLACE: Al Musannah Se, Saudi Arabia.

UNIT: 717th Medical Detachment (Helicopter Ambulance), New Mexico ARNG, recently mobilized.

MISSION: Provide helicopter medical evacuation support to the multinational forces in Operation Desert Shield.

The Iraqi Army is still in Kuwait. The multinational Desert Shield forces are still in place in northeastern Saudi Arabia along its border with Kuwait. The war of words keeps dragging. Neither side has fired.

However, reports say embargo is finally having an effect; Saddam Hussein believes decisive action is necessary; and the Iraqis are configuring their Scud B missiles with chemical warheads. The Iraqis are known to have numerous ZSU-23-4s (self propelled antiaircraft

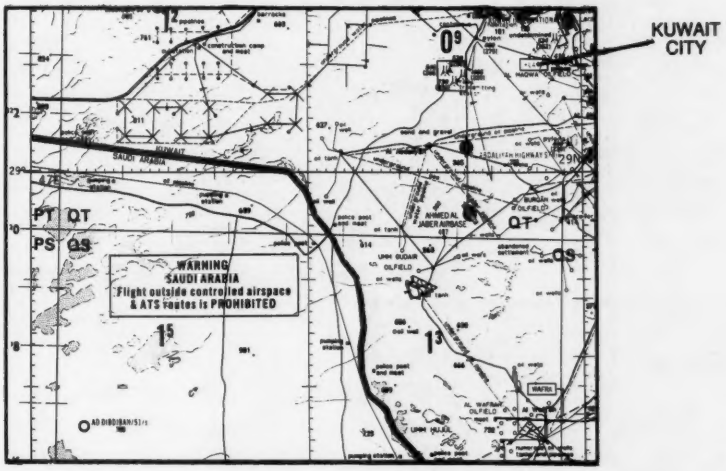
THE DESERT

CW2 Victor E. Carlin

New Mexico Army National Guard

Albuquerque, NM

The opinions expressed in this article are those of the author and do not necessarily reflect the views of any Department of Defense Agency.



vehicles) and other antiaircraft guns and missiles along the border.

The UH-1 Huey medical evacuation (MEDEVAC) crew from the 717th Medical Detachment rests in the "first-up" crew area in their tent next to the 93d Evacuation Hospital. A few night missions occurred since the arrival of the 717th in country.

Most daytime missions have been to pick up heat casualties. From the briefing that morning, the crew knows Desert Shield forces conduct routine night patrolling activities. These events take place from pumping station to pumping station along the oil pipeline just on the Saudi Arabian side of the border with Kuwait.

The time is about 0045 hours; there is no moon; and it is very dark. The only visible lights come from Kuwait City 65 nautical miles to the northeast. Suddenly, a violent explosion shakes the ground and all tents in the area of the first-up crew and the evacuation hospital.

OPERATIONS IN THE DESERT

Shortly after the explosion, personnel in the area notice the smell of new-mown hay.

Troops hear the sounds of large explosions to the north and northeast simultaneously. Within minutes, they hear reports of a missile attack on the front lines and numerous chemical casualties.

Miraculously, the 93d Evacuation Hospital and three of the six Huey medical evacuation helicopters remain operational. All surviving personnel in the rear area immediately go to mission-oriented protective posture (MOPP-4). Nevertheless, chemical casualties in the rear abound and a good deal of confusion abounds. Meanwhile, radio requests from the front lines for medical evacuation support become urgent.

Radio Transmissions

"Dustoff, Dustoff, Dustoff. We have numerous serious chemical casualties...(unreadable)...(static).

"Calling Dustoff. This is Dustoff Operations. Say your unit call sign, the location and number of patients, and the nature of their injuries. Over.

"Dustoff Operations, this is Charlie Med. Patient location is at the police post between Hill 689 and Hill 614. At least 50 patients with chemical burns on arms, hands, necks, and faces. Patients without gas masks no longer exhibit vital signs.

"Charlie Med, Dustoff Operations. Say enemy situation. Over.

"Apparent enemy missile attack, negative ground contact; however, we can hear the sounds of moving heavy equipment or tanks across the border. If you don't get here soon, a lot of these chemical casualties will die."

The MEDEVAC crew for Dustoff 431, the first-up ship, has been in MOPP-4 for the past 5 minutes. Dustoff Operations tells them to launch immediately, that the second-up crew and all other available crews will launch as soon as possible.

The first-up crew, Dustoff 431, has never flown in MOPP-4 at night, and it has never flown in MOPP-4 using night vision devices (NVD). However, it does have a radar altimeter. Therefore, given the enemy antiaircraft artillery threat, it elects to fly unaided (without NVD) at 200 feet above ground level (AGL), but lights out.

The patient pickup site is about 30 nautical miles away. Dustoff 431 takes off at 0100 hours, heading northeast. It should take Dustoff 431 about 20 minutes to arrive at the patient pickup site.

The second-up crew, Dustoff 819, arrives in operations and receives its briefing. The aircraft does not have a radar altimeter. However, 5 years ago, the pilot in command (PC) flew in MOPP-4 using NVD. The second-up MEDEVAC crew immediately plots the location of the patient pickup site on their map. The pickup site is located in a relatively flat sandy area along a road about 2 miles from the Kuwaiti border.

The crew quickly formulates its plan: using NVD in MOPP-4, the MEDEVAC helicopter will fly northeast. It has contour (terrain flight) altitude of 50 feet or less until it contacts an unimproved north-south road. This road leads to an intersection about 8 miles west of the patient pickup site. Then goes east to the patient pickup site itself.

The crew plans to descend to nap-of-the-earth (NOE) altitude, 25 feet or less, when it contacts the unimproved north-south road. About 10 minutes after the takeoff of Dustoff 431, Dustoff 819 puts on its NVD (using the new GX-5 flip-up mounts) and takes off to the northeast at an estimated altitude of 50 feet AGL.

The third-up MEDEVAC aircraft, Dustoff 220, is ready for takeoff about 20 minutes after departure of the first-up aircraft. The crew of the third-up aircraft has never flown

in MOPP-4 at night, and it had never used NVD with MOPP-4. Its aircraft does not have a working radar altimeter, and all remaining NVD have not been tested within the past 90 days.

The crew of Dustoff 220 plots the location of the patient pickup sight on their map and formulates their plan: the MEDEVAC helicopter will take off and climb to 1,500 feet mean sea level (about 500 AGL at takeoff); head northeast; contact Charlie Med; and proceed via frequency modulated homing. Dustoff 220 takes off about 10 minutes after Dustoff 819 and 20 minutes after Dustoff 431.

About 10 minutes after takeoff, Dustoff 819 observes a blinding explosion in the distance that shuts down the crew's NVD for an instant. However, darkness returns, and the NVD quickly readjust to the low-light levels.

The crew proceeds, looking for its checkpoint, the north-south unimproved road.

About 15 minutes after takeoff, the crew of Dustoff 819 still has not sighted the north-south, unimproved road. The aircraft descends to NOE altitude and continues northeast (ever more nervous with each passing minute). Finally, Dustoff 819 sights an unimproved north-south road and turns north. Just as Dustoff 819 turns north, the crew hears the following radio transmissions:

"Charlie Med, Charlie Med, this is Dustoff 220. Describe the lighting configuration at the patient pickup sight. Over.

"Dustoff 220, this is Charlie Med. Pickup site is marked with three hand-held flashlights. Over.

"Charlie Med, this is Dustoff 220. Give us a long count. Over.

"Dustoff 220, this is Charlie Med. Long count follows: One, two, three, four, five, six, seven...(static).... Over.

"Charlie Med, this is Dustoff 220. Give us another long count. There is lot of interference, and we do not as yet have a good fix on your...(static)...(static)....

"Dustoff 220, this is Charlie Med. Say again. Over." ...(static)....

Finding Charlie Med

As the crew of Dustoff 819 listens to the foregoing radio exchanges, it observes a likely explosion in the air about halfway between Al Musannah Se and the patient pickup site. Suddenly, the crew of Dustoff 819 arrives at a road intersection and turns right.

However, for some reason, the compass indicates the aircraft still goes north instead of east. Suddenly, the crew flies by a probable Hawk missile battery pointing southwest. The aircraft slows down and descends to about 10 to 15 feet AGL and continues along at 20 to 30 knots.

Suddenly, the crew observes two tracked vehicles, each with four broom-handle-like objects pointing out of a turret to the southwest. Apparently, the crew has made a serious

navigational error and is inside Kuwait, or else Iraqi forces have crossed the border into Saudi Arabia.

Immediately, Dustoff 819 makes a 90-degree left turn and flies even lower, but faster. Four streams of green tracers go by overhead. Dustoff 819 immediately makes another 90-degree left turn and heads southwest, hoping to find friendly forces and the east-west road it had missed.

After what seems an eternity—but only about 2 minutes on the clock—Dustoff 819 sights what seems to be a building standing by itself in the desert with three faint lights in a rough, triangular formation.

The crew quickly discusses whether or not to go close to the building and lights. Just as the crew decided to circumnavigate the building and the lights, the radio on Dustoff 819 comes to life:

"Dustoff aircraft, this is Charlie Med. You are cleared to land."

Not wanting to take a chance on breaking radio silence, Dustoff 819 does not say anything; however, the crew decides to take a chance and land in the middle of the three dim lights. Upon landing, several figures in MOPP-4 quickly approach the aircraft. There are bodies everywhere, some on litters, some not, most with gas masks, and all in various stages of MOPP.

The flight medic speaks to one of the figures in MOPP-4 standing next to the aircraft. He quickly reports to the PC that they have found Charlie Med. There are 35 to 40 chemical casualties, the extent of injuries unknown, but all serious.

Then someone identifying herself as the commander of Charlie Med comes up to the pilot and asks when the other MEDEVAC helicopters will arrive. The pilot states Dustoff 431 should have been there already and Dustoff 220 is on the way.

He is told no other aircraft have arrived. No enemy ground activity has occurred since the missile attack, but they have observed two explosions southwest of Charlie Med. Meanwhile, given the large number of casualties and the failure of Dustoff 431 to arrive, the crew elects to try to take five litter and two ambulatory patients.

The crewchief removes the crewchief and flight medic seats. Three patients are placed in litters in their normal litter position; two patients are placed on the floor behind the pilots; and one semi-ambulatory patient is placed on each side of the transmission.

The crewchief gets in the aircraft and sits in one of the seats next to the transmission. The flight medic straps herself to the floor in between the two patients behind the pilots. However, the aircraft does not have enough power to lift up to even a 3-foot hover. The PC suggests taking off one or both of the ambulatory patients from the aircraft. However, the medic says they are becoming critical. The crewchief volunteers to get off the aircraft, remain behind at Charlie Med, and help with triage.

Still using NVD, Dustoff 819, with seven patients on board, lifts off the patient pickup site and heads back toward the 93d Evacuation Hospital at Al Musannah Se. Upon arrival at the hospital, a runner from Dustoff Operations says Dustoff 431 and Dustoff 220 are unaccounted; asks Dustoff 819 for any information on the missing aircraft; and instructs Dustoff 819 to return to Charlie Med to continue the mission. Still using NVD and still in MOPP-4, Dustoff 819 returns to Charlie Med's location five more times that night.

All in all, a total of 39 chemical casualties are transferred from Charlie Med to the 93d Evacuation Hospital. By morning, Dustoff 431 and Dustoff 220 are still unaccounted.

What happened to Dustoff 431 and Dustoff 220? The answer lies somewhere between June 1986 and June 1991.

DATE: Five years earlier June 1986.

PLACE: Ft. Carson, CO.

UNIT: 717th Medical Detachment (Helicopter Ambulance), New Mexico ARNG.

MISSION: Annual training.

The unit was scheduled to complete 6 continuous hours of training in MOPP-4 during annual training. On 17 June 1986, the unit workday began at 1700 hours with all personnel appearing in formation in MOPP-2. At that time, the purpose of MOPP training was briefly explained and all personnel were instructed to carry out the regularly scheduled training from 1800 to 2400 hours, but in MOPP-4.

Scheduled training included NVD continuation flight training, aircraft maintenance and maintenance training, section battalion training, management systems training, and the administrative movement of personnel by ground vehicle.

Two NVD continuation training flights were scheduled. One was with the unit instructor pilot (IP), Chief Warrant Officer (CWO) Wayne Sowell, and the acting unit operations officer, Lieutenant (LT) Lonnie Colson. The other flight was with the Fourth Division Standardization IP, CW4 John Morgan; the unit commander, Captain (CPT) Victor Carlin; and the unit trainer, CW3 David Trujillo, together with a crewchief, Sergeant John McCarthy, and a flight medic, Specialist Mike Herrera.

As safety pilots and instructors, the IPs were to use NVD, but not wear chemical protective clothing and gas masks. All personnel were told safety was the primary consideration. Personnel were instructed to immediately stop any training or administrative activity if unsafe in MOPP-4. Personnel were authorized to unmask and take off their chemical protective gloves if necessary to safely continue training or administrative tasks.

All of a sudden, the radio in Operations came to life:

"Dustoff, Dustoff, Dustoff, we have a truck rollover accident and chemical casualties ...(static).

"Calling Dustoff, this is Dustoff Operations. Say your unit call sign, the location and number of the patients, and the nature of their injuries. Over.

"Dustoff Operations, this is Bravo Med, patient location is about 5 miles south of the main road intersection on top of "Agony Ridge"...two patients with gunshot wounds in the lower torso and chemical contamination,

the extent of their injuries is unknown, but serious. Persistent chemical agents are still in the area."

Flight planning and preflight in MOPP-4 were slower than without MOPP-4; however, they were completed without any particular difficulties. CW3 Sowell and LT Colson took off first. LT Colson hovered the Huey and flew one time around the traffic pattern at Butts Army Airfield in MOPP-4 with NVD. However at that point, he landed, took off the M24 gas mask and rubber gloves, and continued the NVD training flight in MOPP-2.

At about 2100 hours, the second UH-1 took off with CW4 Morgan; CW3 Trujillo in the pilot seat in MOPP-4 with NVD; CPT Carlin; and the crewchief and medic in MOPP-4 with NVD in the rear. CW3 Trujillo hovered the aircraft for a few minutes, performed 5- and 50-foot hover checks, flew once around the traffic pattern, and proceeded toward Agony Ridge and the down-range NOE-NVD training areas.

For 1 hour, CW3 Trujillo flew and navigated the aircraft NOE in MOPP-4 with NVD. They flew most of the flight less than 25 feet AGL, as close to the earth's surface as vegetation and obstacles permitted.

At the end of 1 hour, CW3 Trujillo landed in a confined area down-range and switched positions with CPT Carlin. Thereafter, CPT Carlin hovered the UH-1 for a few minutes and then flew and navigated the aircraft NOE in MOPP-4 with NVD for about 1 more hour.

Except for the return for landing at Butts Army Airfield, they also flew most of this flight less than 25 feet AGL as close to the ground as vegetation and obstacles permitted. The aircraft landed at about 2300 hours. At 2400 hours, unit personnel took off their chemical protective clothing and gas masks.

Before the flight, CW3 Trujillo had doubts about the wisdom of flying NVD in MOPP-4. In the daytime, the face plate of the M24 mask distorts one's peripheral vision. Wearing a gas mask and chemical protective clothing is not comfortable, day or night.

However, after hovering the aircraft for a few minutes and flying once around the traffic pattern, CW3 Trujillo quickly decided the M24 gas mask and chemical protective clothing did not degrade any ability to fly safely with NVD. By the end of the flight, CW3 Trujillo was convinced that *aviators can safely fly the UH-1 at night in the NOE environment using NVD while MOPP-4.*

LT Colson took off the gas mask and rubber gloves shortly after the NVD training flight began, because he felt "uncomfortable." CW3 Sowell and LT Colson had flown a high-altitude training flight that same morning. Perhaps fatigue contributed to LT Colson's feeling uncomfortable.

NVD and MOPP-4 Flights

After observing CW3 Trujillo, CPT Carlin was convinced *aviators can safely fly NVD while in MOPP-4.* Flying with NVD while in MOPP-4 himself, CPT Carlin noted his *vision outside the cockpit through NVD was not degraded by the gas mask.* However, reading a 1:50,000 map was more difficult through the gas mask and under the NVD.

The daytime problem of peripheral vision distortion outside the aircraft with the M24 gas mask face plate did not seem a problem. On moonless nights without artificial illumination, one cannot use peripheral vision with NVD except to view the aircraft instruments and the map. Placement of the NVD immediately in front of the M24 face plate resulted in no noticeable difference in an outside view through the goggles than a view without using the M24.

CW3 Trujillo and CPT Carlin wear eyeglasses when they fly. Both have prescription eyeglass inserts in their M24 gas masks, and both wear their eyeglasses when they fly NVD.

However, this did not appear to cause any problems.

The plastic gas mask hoods were not used in the June 1986 flight because of the need to place the NVD straps to the top and sides of the flight helmet. Even with the GX-5 "flip-up" NVD, one cannot use the plastic gas mask hoods without modification. For instance, they could possibly cut holes or slits in the hoods to accommodate the two methods of attaching NVD to the flight helmet.

At the end of the NVD MOPP-4 flight training period in June 1986, CPT Carlin concluded that with proper training, the crew can safely perform NVD flights in MOPP-4. Additionally, he concluded *NVD flight in MOPP-4 must be essential under two conditions:* if NVD are essential to flight in a high-threat environment, and if MOPP-4 is essential to survival in a high-threat environment. It follows that if we are going to be expected to fly and fight in war using NVD and MOPP-4 at the same time, we need to train that way in peacetime.

Meanwhile, however, upon the unit's return from Ft. Carson to its base at Santa Fe, NM, the state Army Aviation officer instructed the unit to discontinue further flights using both NVD and MOPP-4 at the same time.

In February 1988, CPT Carlin submitted an article to the *Aviation Digest* detailing the unit's NVD MOPP-4 training at Ft. Carson in June 1986. Because the *Aviation Digest* did not respond, CPT Carlin inquired about the status of the article in November 1988. CPT Carlin received a letter from the *Aviation Digest* with comments from Army entities:

- This article should not be printed. There are test results from developmental testing of the XM40 and XM43 programs that show the M24 is not compatible with NVD. This incompatibility is primarily due to loss of field of view.
- The conclusion should place more emphasis on the necessity for aircrew continuation training to ensure safe conduct of NVD flight in MOPP-4. Recommendation: Staff the article at the Aviation Training Brigade and Directorate of Combat Developments, U.S. Army Aviation Center, Ft. Rucker, AL, for further comments.
- The M24 mask has distortion problems and I do not believe they will go away at night. ...Until the Army has fielded MOPP clothing and equipment designed for aviation usage, and it is determined to be compatible with NVD, no requirement training programs in this environment should exist.

CPT Carlin's 1988 article was never published by the *Aviation Digest*. Since June 1986, neither the 717th Medical Detachment nor any other unit in the New Mexico ARNG has performed NVD flights in MOPP-4.

Perhaps those who believe no one can perform NVD flights in MOPP-4 can answer this question for aircrews in Saudi Arabia: *How does one choose either NVD or MOPP-4 when survival depends on the simultaneous use of both?*

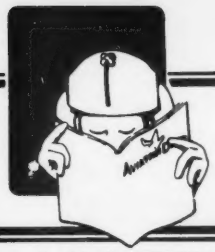
When we fight, we fight the way we trained. Therefore, subject to safety considerations, *we need to train the way we plan to fight. In other words, we need to train using MOPP-4 with NVD in peacetime under certain conditions:* if flight in MOPP-4 is essential in a high-threat environment; if flight with NVD is essential in a high-threat environment; and if we are going to be expected to fly in a high-threat environment.

It is not enough to say the subject should be staffed for further comment. With soldiers on the ground in Saudi Arabia in a high-threat chemical environment, we need to promptly begin training in simultaneous use of NVD and MOPP-4.

Postscript

Dustoff 431 flew into the top of hill 981 about halfway to its patient pickup site. Dustoff 220 was shot down by an Iraqi missile. The crew of Dustoff 819 survived the war, but the aircraft had to be scrapped because of severe corrosion caused by chemical decontamination spray.

VIEWS FROM READERS



Editor:

The Ohio State University will host the Sixth International Symposium on Aviation Psychology 28 April through 2 May 1991. The Ohio State University Department of Aviation Psychology Laboratory and the *International Journal of Aviation Psychology* staff is sponsoring the Symposium. The meeting will be held in the Hyatt Regency, Ohio Convention Center, Columbus, OH. This year's theme, "Information Transfer for a Safer Aviation System," reflects the emerging issue of importance in our field. The objective of the Symposium is to examine and improve the role, responsiblity, and performance of human operators in the aviation system. Specific topics will include but not be limited to the following:

- Cockpit Technology.
- Pilot Reliability.
- Pilot Workload.
- Pilot Judgement.
- Pilot Selection.
- Pilot Training.
- Pilot Certification.
- Cockpit Resource Management.
- Air Traffic Control Human Factors.
- Simulation.
- Visual Perception.
- Accident Investigation.
- Physiological Factors.

Richard S. Jensen, Ph.D.
Director, Symposium on
Aviation Psychology
Commercial 614-292-5460
Fax 614-292-5020

Editor:

Although I have been out of aviation since shortly after my return from Vietnam, it has always bothered me that both your publication and *Soldier* magazine have treated the CH-54 Skycranes, the units that had them and used them in Vietnam, and the men and women who served in these units, with benign neglect. Again in your May/June 1990 issue the article, titled "Grand Opening, Army Aviation Museum," they are again missing. I know you do not do this on purpose.

I certainly hope the aviation museum has one to show off. I know you have one of the Guns-A-Go-Go CH-47s that I had a part in delivering to Hotel-7 (Saigon) for shipment to the museum.

The 478th Aviation Company (Heavy Lift) Skycranes, known by-their call sign as Cyclones performed in a superior manner throughout the war. In particular, the 3d Platoon, first located at Long Binh and then at Vung Tau, was called on to perform difficult and dangerous missions and yet, sadly enough, little if anything has ever been written about their feats.

Lastly, formal recognition by way of unit citations, except for the Vietnamese Cross of Gallantry given to the whole 1st Aviation Brigade, are also noticeably missing. We deserve better than that. It is long overdue. Give us our due!

CSM Victor A. Gomez
359th Theater Signal Brigade
Liverpool, NY

Editor:

I am the full-time aviation life support equipment (ALSE) technician for the Army Aviation Support Facility in Connecticut. I belong to the Army National Guard (ARNG). I am concerned with the PEARL'S article, "Back to Basics," published in the July/August 1990 issue of the *Aviation Digest*.

I agree with some of the concerns that were written in the article. I am sure that a small percent of ALSE technicians are not performing inspections and maintenance *by the book*, but also I know that there are a lot of us who do go *by the book*.

I think that there are some points you should know. How can a unit commander take ALSE seriously when there are no slots or military occupational speciality (MOS) in his unit for ALSE? The additional skill identifier just does not meet the requirement. So during weekend drills, I have to perform my duty MOS and the ALSE program takes a back seat. This doesn't just happen in the unit where I am assigned, it happens just about everywhere within the ARNG.

Another point is that a good number of school-trained ALSE technicians hide the fact that they are trained because of a lack of career advancement. The last fact is that Army Regulation 95-3, *General Provisions, Training, Standardization and Resource Management*, states that a desirable ratio is 1 full-time ALSE technician to 50 persons on flight status. This just does not happen. I have a 1:176 ratio for instance.

I can proudly say that the crewmembers I support have one of the best ALSE programs available to anyone in Army Aviation today. I go *by the book* and take *great pride* in the job I am doing as I am sure other ALSE technicians are doing.

SPC David T. Dwelley
ALSE Techician
Connecticut ARNG

Readers can obtain copies of material printed in any issue by writing to: Editor, U.S. Army Aviation Digest, P.O. Box 699, Fort Rucker, AL 36362-5042.

AVIATION PERSONNEL NOTES

Army Aviation Personnel Plan (A^2P^2)

The Army Aviation Personnel Plan, better known as A^2P^2, has been updated. It is now being distributed worldwide. This professional development guide is a handy reference tool. It provides information on branch accession requirements, career development, schooling, and functional area use.

The new 1990/1991 A^2P^2 contains all of the latest professional development changes for Aviation Branch soldiers. It covers the entire rank spectrum. Also in this edition is the new foundation for a professional development plan for Department of the Army civilians who support the Aviation Branch.

All of you are encouraged to read A^2P^2. Keep a copy nearby to which you can refer when professional development questions come up. You are encouraged to submit recommended changes or additions to A^2P^2 to the Aviation Personnel Proponency. The address is in A^2P^2.

Changes to Army Regulation (AR) 611-201

On 25 October 1990, a packet of major changes to AR 611-201, *Military Occupational Handbook*, affecting primary military occupational specialty (MOS) 93C, air traffic control operator; and 93D, air traffic control systems, subsystems and equipment repairer, was forwarded to the U.S. Army Personnel Integration Command, Alexandria, VA, for evaluation and worldwide staffing.

Some of the changes that will affect air traffic control are as follows: The title of the MOS will change from air traffic control to air traffic services. The standards of grade explanatory notes will change to add pathfinder additional skill identifier (ASI) to the tactical teams and tactical air operation ASI of the S2/S3 section at battalions, A^2P^2 section at headquarters and headquarters company, corps support company, communications zone support company, and division support company.

The changes for primary MOS 93D are minor. The explanatory notes were changed to more clearly define the job titles. Once these recommended changes are approved by all elements involved, they will appear in the October 1991 update of AR 611-201.

These recommended changes support the L-edition table(s) of organization and equipment prepared by the Directorate of Combat Developments, Ft. Rucker, AL.

FLIP Account Managers

Master Sergeant(P) Walter McPherson
U.S. Army Aeronautical Services Office
Cameron Station, Alexandria, VA

A GOOD flight information publication (FLIP) account manager is invaluable to his or her unit. Without current and adequate FLIPs, no unit can safely complete its mission. Working closely with many Army account holders has revealed that commanders put too little emphasis in assuring that the FLIP account managers are knowledgeable and that FLIP accounts are properly monitored and maintained. There are many misunderstandings concerning these accounts. Contrary to popular belief, "the sky does not open up and allow publications to fall into place" simply because you have aviators assigned. Nor is each pilot authorized a personal set of FLIPs. Therefore, with this article I shall attempt to explain what FLIP material is and how FLIP accounts are managed. I will answer some often asked questions and explain where you can receive help if needed.

This information is available in the Defense Mapping Agency (DMA) *Catalog of Maps, Charts and Related Products*, part I, Volume I, "Aerospace Products." However, this article may be retained as a quick reference to assist account managers.

The DMA Aerospace Center, St. Louis, MO, provides all military services with all publications for flight planning, en route navigation, and terminal procedures. These publications are commonly called FLIPs. FLIP materials include planning documents, the *Flight Information Handbook*, en route supplements, en route high and low charts, and high and low terminal procedures. In addition to the FLIP, the DMA Combat Support Center, Washington, DC, provides a list of materials called FLIP-related products. These include tactical pilotage charts, joint operations graphics-air, operational navigational charts, visual flight rules (VFR), terminal area charts, VFR sectionals, foreign clearance guides, Federal Aviation Administration handbooks, federal aviation regulation parts, and DMA catalogs.

Each FLIP account must be verified annually. Many account holders are not aware of the importance of the FLIP and FLIP-related surveys. When they receive them they merely sign the computer printout, make a statement such as "no changes," and return them hoping that everything goes well. Several weeks later, when they receive a maintenance page, they discover they are receiving too many of some publications and not enough of others. Then a request for change must be submitted. Your printout, both the survey form and

maintenance page, is a complete listing of the products being shipped to you each cycle. You must review this printout for accuracy and correct it immediately. If you find that you have several publications to discard or that you run short of the same publications each cycle, you need to adjust the account. The survey affords you the opportunity to accomplish this. You don't have to wait until it is survey time to correct the account. It is just plain good management techniques to plan your usage and adjust the account once a year. A periodic review of your account gives you a chance to prevent expensive waste that results from getting publications you don't need. If you need help in determining your quantity levels, review section 4, "Basis of Distribution Tables," and section 5, "Basis of Issue Tables," in the DMA catalog. You may call your aeronautical services office (ASO) FLIP account manager at AUTOVON 284-7773/7774 or Commercial 202-274-7773/7774. This information is also available in revised Army Regulation 95-2, *Air Traffic Control, Airspace, Airfields, Flight Activities and Navigational Aids.*" All unit FLIP account managers should obtain a copy of this regulation for reference.

After submitting your updated survey form, the account will be updated and a copy of the FLIP address and requirements maintenance page will be returned to you. That copy confirms your mailing address and your account levels. Now your only worry is the timely arrival of your updated publications. All flight publications have a limited use period. Flying without current FLIPs is hazardous and may contribute to violation of flight rules and procedures. All FLIPs should arrive at least 1 day before their effective date. If you do not receive them, first look around the mailroom, maintenance office, and supply room. If this search is fruitless, determine the mode of transportation and normal arrival point for your FLIP; i.e., surface transportation to the transportation officer or air to the post mailroom. Contact the transportation officer or postal officer and request a search for the product. If these efforts are still unsuccessful, contact other nearby users to determine if they have received their publications. If publications have not been received by close of business the day before the effective date, contact your ASO FLIP account manager and explain your situation.

In this period of high mobility, many units are moving or being deployed for training in areas outside their primary area of operation. Units normally don't have sufficient publications to support the training nor to deploy the aircraft. In such a case, one-time shipments of specific publications are required. Many times units know well in advance that a deployment is planned. If time permits, submit your request with as much lead time as possible for processing the request and shipping your publications. Stockage is not necessary nor authorized to support training exercises. Publications can routinely arrive within 3 weeks. Emergency shipments are handled in 2 to 3 days and can be shipped overnight in an emergency. However, this type of response is discouraged because of the high cost of shipment.

One last suggestion: FLIPs are issued based on assigned aircraft. There are not enough copies to allow each aviator a personal set of FLIP products. Some units have prepared enough mission flight kits in sufficient quantities to support their missions. These kits are issued to the crew of a particular mission. Upon completion of the flight, the kits are returned to operations. This is proving to be a successful and cost-effective arrangement.

U.S. Army Air Traffic Control Activity-ASO is here to assist you in the acquisition of necessary flight publications. If you have a problem, or need help in setting up your account, or if you have difficulty in establishing needed quantities of publications, please contact your ASO FLIP account manager.

USAASO invites your questions comments and may be contacted at AUTOVON 284-7773.

ATC FOCUS
U.S. Army Air Traffic Control Activity

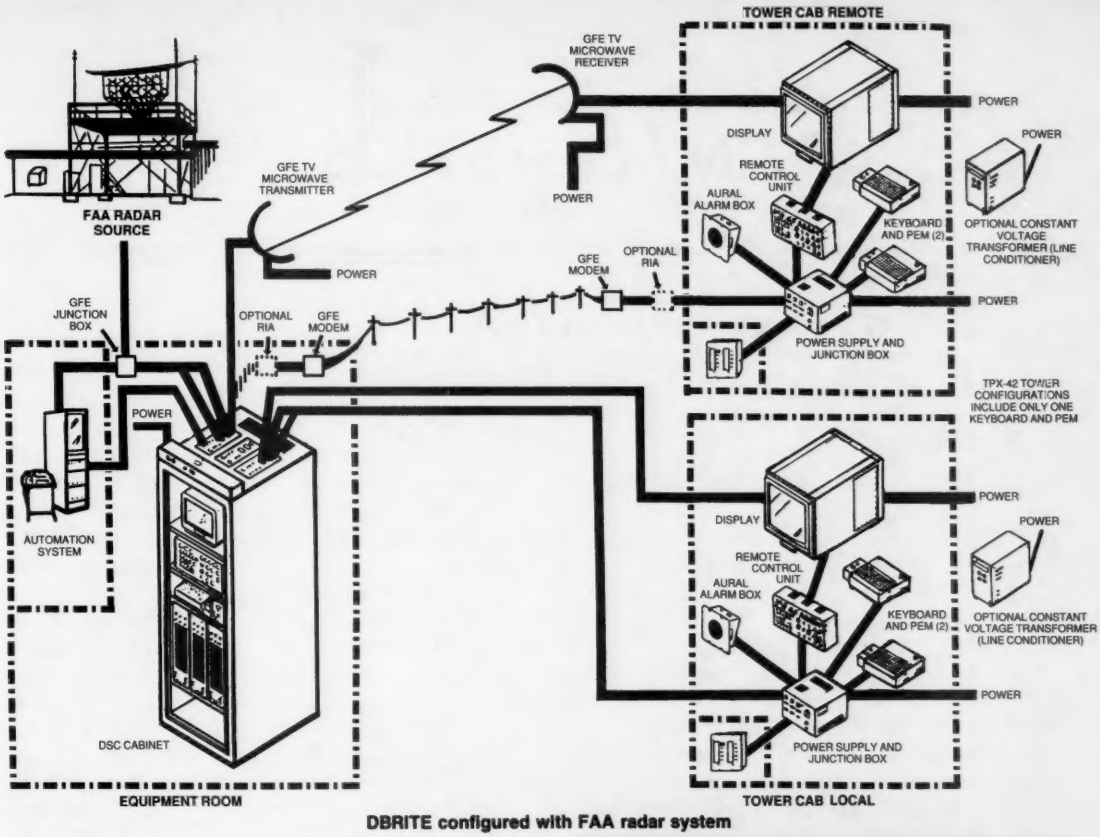
The Digital Bright Radar Indicator Tower Equipment System

Master Sergeant Chet Spangler
U.S. Army Air Traffic Control Activity
Fort Rucker, AL

THE DIGITAL BRIGHT Radar Indicator Tower Equipment (DBRITE) system is being fielded at selected Army air traffic control (ATC) facilities. This system replaces outdated Bright Radar Indicator Tower Equipment, BRITE II and IV, systems. The DBRITE system is part of the Army ATC radar systems upgrade. The upgraded system accepts radar, beacon, external map analog video, and automation system data. These signals are combined with internal DBRITE digital site maps, compass rose, and range marks into a composite television signal. This signal is presented on the facility display unit. The DBRITE system originally was developed and designed for use in airport traffic control towers by the local controller. However, the system has been expanded. It now includes ground-controlled approach for airport surveillance radar service and Army flight following facilities. This enhances flight following capabilities in training areas. The volume of traffic in terminal and training areas has increased. It has become difficult to rely only on visual control. The DBRITE system enhances the controller's ability to control traffic during varying visibility conditions. The system also aids the controller by improved control of aircraft with a wide range of approach speeds. It provides safer control at larger airports and training areas.

The local controller is responsible for accurately sequencing arriving visual flight rule traffic with instrument flight rule (IFR) arrivals. The controller provides separation between successive IFR arrivals and departures. Local control may also be responsible for providing separation between successive IFR arrivals inside the final approach fix. In the interest of efficiency, the controller must take full advantage of minimal separation in releasing departing aircraft. At the same time, he or she must maintain a proper margin of safety. The system provides altitude readout and aircraft call signs. When the capability exists in the associated radar facility, the DBRITE system allows the controller to perform semiautomated functions. The system also provides improved aircraft identification at remote indicator terminals.

A variety of other ATC systems interface with the DBRITE system. It can perform and display all functions generated by the parent radar or automation system indicator. With these capabilities, selected control towers are able to provide radar approach control services during low-density traffic periods. These capabilities allow for combined

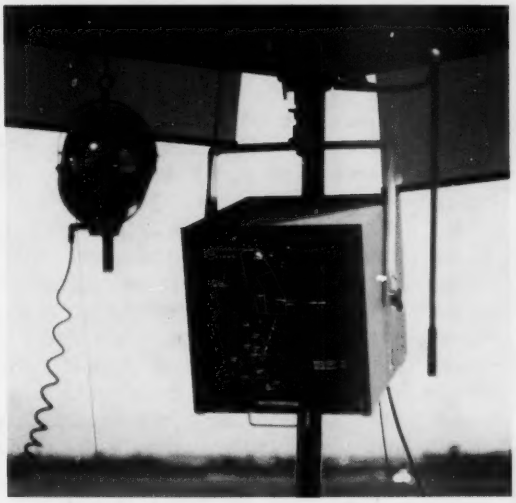


DBRITE configured with FAA radar system

operations. This results in significant manpower savings.

The DBRITE system also provides a mapping function that includes five digital maps. These maps are selectable in any combination. To use this function to its fullest, these maps should depict airfield boundaries, reporting points, extended runway center lines, approach fixes, and final approach fixes. The maps also should depict navigational aids, restricted areas, and obstructions within the control zone or airport traffic area. These functions provide improved aircraft identification in congested areas.

As the DBRITE system becomes widely operational it will reduce the possibility of midair collisions and aid in decreasing serious incidents in congested airspace.



Tower Display Indicator

Readers are encouraged to address matters concerning air traffic control to Commander, USAAVNC, ATTN: ATZQ-ATC-MO, Fort Rucker, AL 36362-5265.

AVIATION LOGISTICS
U.S. Army Aviation Logistics School

TEST PILOT STANDARDIZATION

Lieutenant Colonel Douglas A. Cahill, U.S. Army Aviation Logistics School, Fort Eustis, VA

THE DIRECTORATE of Evaluation and Standardization (DOES), U.S. Army Aviation Logistics School (USAALS), Ft. Eustis, VA, is an integral part of the Headquarters, Department of the Army (HQDA), Aviation Standardization Team. A memorandum of understanding with Office, Deputy Chief of Staff for Operations and Plans, HQDA, outlines DOES' responsibilities. The DOES team members evaluate maintenance test flight evaluators (MEs) and maintenance test pilots (MPs) in the Active Army and Reserve Components. Evaluations are done according to Army Regulation (AR) 95-1, *Army Aviation Flight Regulations*; AR 95-3, *Aviation: General Provisions, Training, Standardization, and Resource Management*; Field Manual (FM) 1-544, *Standardized Maintenance Test Flight Procedures*; appropriate aircraft maintenance test flight (MTF) manual checklists; and aircrew training manuals. The DOES evaluates the effectiveness of individual units, in addition to resident and nonresident MP training portions of the Army Aviation standardization program.

The DOES has observed two significant shortcomings during our Armywide visits. One shortcoming is a general lack of command emphasis on integrating MPs into the Commander's Aircrew Training Program (ATP). Another shortcoming is a rather casual approach to training and using MEs. In the DOES, we believe these shortcomings are the result of one primary fact—commanders are not driving MP standardization and training from the top down.

Commanders at all levels, from battalion through echelons above corps, have traditionally recognized the need for a staff-level standardization office, or element, to oversee the administration of the ATP. These individuals are selected from the most experienced instructor pilots (IPs) in the command. They are not based on modified table of organization and equipment authorizations. The selection is based on the commander's desire to promote safety and unit mission accomplishment through aviation standardization.

An identical need exists to include the ME as part of this standardization effort. The ME should do many critical and practical tasks for the commander. These tasks relate directly to aviation safety and enhance the ability of the unit to accomplish its mission. MPs who know how to manage personnel, troubleshoot faults, and test fly aircraft are essential for safety and aircraft availability. The ME's role is to ensure MPs are properly trained to perform these tasks. MEs evaluate MPs to see if their performance meets the standard. If the MP is not performing to standard, the ME diagnoses the fault, applies corrective action, and then re-evaluates the MP to ensure proper performance.

This simple procedure is not used primarily because of the traditional manner in which MEs are trained and used. The ME position is an additional duty for a test pilot/maintenance officer who already has a full plate of duties. This officer is likely to be a production control officer, quality control officer, technical supply officer, allied shops officer, and armament officer. In addition, the ME is often required to perform other duties, such as weapons officer or nuclear, biological, and chemical warfare officer. This officer is likely to be performing duties as a test pilot in more than one aircraft. The additional role as an ME is not often viewed as a real bonus. Personal pride is currently the only incentive to be an ME.

Often the only training an ME receives is an initial ME qualification evaluation conducted by

another ME despite the minor training requirements listed in FM 1-544. A waiver had to be requested on these requirements.

Training on the fundamentals of instruction is limited. Current regulations require that someone receive only 1 hour of training on the fundamentals of instruction to be certified as an ME.

MEs are usually good maintenance officers and maintenance test pilots. However, they are not experienced in using the requirements listed in Training Circular (TC) 1-210, *Aircrew Training Program Commanders Guide*, that tells how to conduct effective training or how to prepare effective evaluations.

Aviation commanders at all levels should take these actions to ensure all assigned MPs are meaningfully included in the ATP:

- Include an ME in every standardization element. Any place a standardization section exists for pilots, it must include the MTF community.
- Ensure that ME training is conducted by an IP or Standardization Instructor Pilot (SP). The training should include instruction on the ATP according to TC 1-210, and fundamentals of instruction according to Field Circular 1-222, *Rotary-Wing Instructor Pilot Handbook*. This training is grossly overlooked in the field. The SP community has a tendency to shy away from the ME community. The commander must marry these two elements together and they must work together for harmony and safety throughout our pilot community.
- Develop an ATP that will include a special mission task list for MPs that outlines all test flight tasks as required special mission tasks. FM 1-544 provides the minimum basic requirement of four iterations a year as a guide for a test pilot.

The ATP will also—

- Require maintenance test flight evaluation for MPs and MEs as part of the annual proficiency and readiness test (APART) requirement.
- Ensure progression of the MP to readiness level 1 (RL1) occurs after the successful completion of MP training and evaluation. The DOES continually finds MPs in the field who have not had an annual evaluation; however, they have progressed to RL1 status during their APART. This happens when the SP and IP community do not become involved in the requirements for the ME community.
- Include MP and ME no-notice evaluations in the commanders no-notice evaluation program. The DOES continues to find units in the field that have excellent no-notice programs for the entire pilot community; however, these units have not checked a test pilot lately.
- Require the ME to provide regularly scheduled MP/ME training. At a minimum, the DOES recommends an ME at the brigade level be assigned to oversee the overall program, encompassing all other assigned MEs. This is not necessarily a full-time job. However, the designee should be an ME who can function in the same manner as the SP, run the overall standardization program for the commander, and work with the SP to develop an overall ATP for the entire aviation community. This ME should be given the authority to do the job and be relieved of numerous extra duties.

MEs performing as part of a standardization element should be senior rated by the commander at that particular level. The brigade ME should be senior rated by the brigade commander. The commander is the critical element in the maximum use of these key personnel. Commanders at all levels must ensure MPs and MEs are integrated into the unit's ATP and the ME provides technical expertise and staff overview in the training, evaluation, and use of MPs.

The DOES will provide on-site training for your designated brigade level ME, if requested. The DOES will also conduct this training, upon request, during normally scheduled DOES visits to the field.

The ME should not be added to the standardization element simply to fill a regulatory requirement. ME standardization and training are a readiness issue. Highly trained test pilots supported from the top down raise readiness rates, thus allowing our Army to perform its wartime mission.

The DOES also collects feedback from the field on issues about the USAALS. We solicit comments on the quality of the USAALS training, its graduates, and any test flight or maintenance-related issues. The DOES HOTLINE, USAALS, is Defense Service Network (DSN)/AUTOVON 927-6166 or Commercial 804-878-6166. Calls we receive after normal duty hours we record and answer the next duty day. The daytime number to the Maintenance Test Flight Standardization Division is DSN/AUTOVON 927-3266/4164 or Commercial 804-878-3266/4164. Individuals unable to call should send comments to the Assistant Commandant, USAALS, ATTN: ATSQ-LES (LTC Douglas A. Cahill), Ft. Eustis, VA 23604-5429.

Enlisted Crewmembers: To Pay Or Not To Pay?!

Sergeant First Class Drake Willoughby
Directorate of Evaluation and Standardization
U. S. Army Aviation Center
Fort Rucker, AL

THE ADVENT OF enlisted Aircrew Training Program requirements has caused many misconceptions concerning the logging of flying time for pay. Enlisted crewmembers may log all their flying time toward total time, but not all flight time may be used for flight pay purposes. The cardinal rule to remember when applying flight time for pay is stated very clearly in Army Regulation (AR) 600-106, *Flying Status for Nonrated Army Aviation Personnel*, paragraph 7. It states in part, "Flying time to qualify for entitlement to flight pay must be a product of the performance of duties which required the person to be placed on flying status orders." In other words, if a person is placed on orders to perform crewchief duties, the only time that can be applied for pay is the time actually spent performing crewchief duties during flight. This rule applies to all crewmembers—crewchiefs, flight engineers, etc.

The next rule that must be applied pertains to the number of enlisted crewmembers authorized for each aircraft type. AR 600-106, paragraph 9c(1) through (9), authorizes the number of crewmembers for each aircraft listed on the unit's modified table of organization and equipment (MTOE), or table of distribution and allowances (TDA). For example, the UH-1 Huey and the UH-60 Black Hawk are authorized one crewchief for each aircraft. In Army Aeromedical evacuation units, 1.5 crewchiefs and 1.5 medical aidmen are authorized.

Many commanders required enlisted crewmembers to train other enlisted crewmembers for night vision devices (NVD) flights. A recent U. S. Total Army Personnel Command, Alexandria, VA, response to a Directorate of Evaluation and Standardization, Ft. Rucker, AL, request for clarification on flight pay authorization for enlisted crewmembers resulted in a relaxation of the rules governing the logging of flying time for pay during these flights. The revised AR 600-106 will be printed and available for distribution by the 3d quarter of fiscal year 1991.

Two major changes now in effect for NVD flights are as follows:

- When an enlisted crewmember who is NVD-current and qualified is training another crewmember, both can log flying time for pay during the same flight.
- If two crewmembers are positioned in the rear of a UH-1 or UH-60 to observe both sides of the aircraft, each crewmember may log flight time for pay. (Reference: Department of the Army (DA) Message 141433Z June 1989.)

Logging noncrewmember flying time to qualify for pay is difficult and next to impossible under current DA guidelines. Most affected are the repairmen who work long, hard hours to maintain a favorable operational readiness rate and the techni-

cal inspectors (TIs) who ensure the mandatory preciseness of aircraft repair work. Under current regulations and published guidance, a repairer must be physically performing repairs during flight and a TI must be physically inspecting repairs during flight to log time for pay. Total time for such flights cannot be used for pay.

Let's say that again in a different way. Only the actual time spent repairing or inspecting an aircraft in flight can be used to accrue flight time for pay. The time spent in transit as a passenger cannot. Furthermore, enlisted personnel who log time for pay must be in the type aircraft that the individual is slotted against on the unit's MTOE or TDA; i.e., UH-60 TI. The commander may require this individual to perform TI duties on both UH-60 and AH-1 Cobra aircraft. This individual may log flight time for pay in the UH-60 only. Probably the only noncrewmember who should be able to make the monthly hour requirement for pay, fairly consistently, is the flight platoon sergeant of a unit authorized crewmembers. The platoon sergeant must train and maintain the proficiency of his crewmembers who generally do not lack flying time for pay.

Ironically, one of the more commonly encountered factors resulting in misuse of flight time for pay concerns commanders' actions. Many are authorizing and, in some cases, directing flight time be applied toward pay when that time is not authorized by regulatory requirements. Commanders should be concerned that their enlisted crewmembers and noncrewmembers receive the flight time for pay that they deserve. Perhaps "deserve" is not a sufficient description under normal circumstances. Maybe "All commanders should be concerned that their enlisted crewmembers and noncrewmembers receive the flight time for pay that they have earned under current regulatory requirements" is more applicable. One example could be a commander who identifies crewmembers or noncrewmembers already on flying status who have trouble acquiring enough flight time for pay. He places them on unit orders for additional duties concerning flight; i.e., doorgunner, aerial observer, aerial photographer, etc. This allows them to log flying time for pay "wearing their additional duty hats."

Several fallacies to this quick-fix scenario follow. First, to be considered paid flight positions, those additional duty examples mentioned must be authorized as flying duties on the unit MTOE or TDA. Second, individuals involved can only apply flight time for pay while performing the duties, by job description, and in the aircraft type for the single MTOE or TDA position that they occupy. Only one person can occupy a single position. In addition, noncrewmembers *will not* be credited with flight time for pay purposes while performing crewmember duties and vice-versa. Noncrewmember and crewmember are entirely two different categories of flying status. The quick-fix scenario also contradicts AR 600-106, paragraph 7.

I admire the commanders who have aggressively pursued a program that allows the maximum number of soldiers to be used on flying status to complete their mission. A main ingredient found in any effective fighting force is morale. What better way to maintain good morale than to ensure all those soldiers who are needed to complete the mission are allowed to earn hazardous duty incentive pay? During peacetime, extra pay is not the only contributing factor to good morale by a long shot; it is, however, well ahead of whatever is in second place. Because legitimate noncrewmember flight time for pay is extremely hard to acquire, commanders should pay special attention to AR 600-106, paragraph 10, which states in part: "Commanders will ensure that only those persons needed to accomplish the assigned mission are placed on this status."

Audit and inspection teams are governed by current ARs. The teams must identify those discrepancies concerning flight hours applied toward pay contrary to published requirements. Quite often the end result is soldiers' paying back months of flight pay that they already may have spent. This can cause financial hardship.

DES welcomes your inquiries and requests to focus attention on an area of major importance. Write to us at: Commander, U.S. Army Aviation Center, ATTN: ATZQ-ES, Fort Rucker, AL 36362-5208; or call us at AUTOVON 558-3504 or Commercial 205-255-3504. After duty hours call Fort Rucker Hotline, AUTOVON 558-6487 or Commercial 205-255-6487 and leave a message.

This article is a success story. It is a claim you can judge for yourself based on the results presented here. It is a story of *training, persistence, maintenance* and *leadership.* It is a story, I hope with as many sequels as there are attack units in the Army.

Apaches at the NTC

They're Here!

Major Michael L. Poumade
Combat Aviation Brigade
First Cavalry Division
Fort Hood, TX

SUCCESS FOR AH-64 Apache units at the National Training Center (NTC), Ft. Irwin, CA, has been as elusive as a poltergeist. Desert Iron II, NTC Rotation 90-10, changed the Krosnovian (opposing forces) battlefield forever. The AH-64 proved itself a force to be respected and, like the supernatural beings in *Poltergeist*, a presence to be dreaded.

The viability and lethality of the AH-64 have been accepted in military journals, forums, and the aviation community for years. However, justly, our combined arms brethren have held to the adage "seeing is believing." Until the Apache *consistently* demonstrates its prowess on the battlefield, supporting division or corps troops, the claims will be viewed as suspect.

One of the best proofs of the Apache's combat capability is on the NTC battlefield. Alongside the other members of the battle task force (TF) the Apache scored kills on the Krosnovian horde. To score these kills objectively requires an operable multiple integrated laser engagement system/air ground engagement system (MILES/AGES) II system. At last, training technology is gaining on tactics and weapons systems. This technology will enable Army Aviation to demonstrate the Apache's impact on the battlefield.

TF 1-227 AVN, Aviation Brigade, First Cavalry Division (including observer controller aircraft), deployed to the NTC. Deployed also were 11 AH-64s, 8 OH-58C and 4 OH-58D Kiowas, 5 UH-1H Hueys, 2 UH-60A Black Hawks, 2 CH-47D Chinook aircraft and 335 personnel. The First Battalion, 227th Aviation Regiment;

augmentation from D Company, 227th AVN; E Company, 227th AVN; F Company, 227th Aviation Intermediate Maintenance (AVIM); 2-58th AVN; 2-158th AVN (6th Cavalry Brigade); and the U.S. Air Force weather team comprised the TF.

The deployment encompassed rail, C-5A Galaxy airlift and self-deployment. TF 1-227 fought alongside the ground forces TFs of 1-155 Armor (Mississippi National Guard) and 3-32 Armor of 1st Brigade (Ironhorse), 1st Cavalry Division, in eight of nine battles. We missed one battle because of high winds and turbulence, which would have incurred an unacceptable risk to our scout aircraft. In these *eight* battles, the TF made its presence felt from the onset.

Training

In the *first* battle, a battalion TF defense, 1-227 AVN, destroyed 22 vehicles with HELLFIRE shots. There was no loss at the hands of the Krosnovian forces. This tally exceeded that of entire rotations of aviation units in the past.

The *second* battle was a movement to contact/hasty attack in which the Krosnovian divisional reserve was not committed in the TF sector. The ground TF dealt with the regimental reserve (seven tanks).

The *third* battle was a reconnaissance—deliberate attack and counterattack. Six Krosnovian combat vehicles were destroyed at no loss to TF 1-227.

The *fourth* battle defense in sector followed with seven kills and no TF losses.

The *fifth* mission was another movement to contact and attack a counterattack force. The result was six Krosnovian kills and one AH-64 lost to artillery.

The *sixth* battle was a deliberate attack with only three kills and no TF losses.

The *seventh* battle was the most successful engagement—a defense in sector. Seven AH-64s destroyed 38 combat vehicles. The joint air attack team (JAAT) destroyed an additional 10. The TF was able to deny the Krosnovians Red Lake Pass. This battle demonstrated the flexibility of attack helicopter operations since engagements began in the north by attack units. Then the TF quickly was cycled into engagements in the east as the enemy made its major push there against a more lightly defended area. The keys to success were integration into the ground maneuver plan, rehearsals and execution. This led to "...a historic aviation first at the NTC," according to Brigadier General Wesley Clark, the NTC commander.

The *eighth* battle was a deliberate attack with seven combat vehicles destroyed by AH-64s. An additional seven vehicles were destroyed by the OH-58Ds' use of artillery.

Total validated kills were 103 for the TF versus 3 AH-64s and 3 OH-58s. Two OH-58s were lost in counter-reconnaissance mission to dismounted reconnaissance teams—an admirable

The AH-64 Apache attack helicopter proved itself a force to be respected and, like the supernatural beings in* Poltergeist, *a presence to be dreaded.

Apaches at the NTC

As the aircraft tapes showed, enemy vehicles usually had no knowledge of the Apaches' presence until their lights illuminated.

exchange ratio. The tally might have been even greater; however, the kill code (21) for the 30mm initially was not recognized by the controllers and considered bogus in some cases.

The impact of the Apaches and OH-58s on the battlefield was strong, especially in the types of engagements in which doctrine states that attack helicopters would be most effective. The Krosnovian forces proved their resourcefulness. They lived up to their reputation by adapting to the Apache threat with increased artillery on suspected attack helicopter battle positions. The Krosnovians also increased use of the wadis as the war progressed, in response to the range of the HELLFIRE. As the aircraft tapes showed, enemy vehicles usually had no knowledge of the Apaches' presence until their lights illuminated.

The MILES/AGES II is not perfect yet. The probability of kill was not what it should have been based on live-fire data and aircraft tapes. MILES/AGES II still requires much time for installation, boresighting and maintenance. MILES' effectiveness diminished at ranges beyond 5,500 meters. Currently, no effective system exists for rockets. With all that said, it was still invigorating to have aviation influence the battle, and have that acknowledged by our combined arms peers. It was worthwhile to have feedback for the crews on their lethality and survivability. It also validated doctrinal employment concepts that we have accepted intellectually but never were able to test at the unit with objective force-on-force battles. It enabled man-in-the-loop analysis of collective engagements versus reliance on computer simulation. The results increased our confidence levels in the success of our employment techniques and reinforced the lessons learned in the computer-supported war games.

Persistence

As stated earlier, this is a success story. Now you will probably agree. The ingredients included *persistence*. This was First Attack's third trip to NTC with MILES/AGES. Many agencies and officials provided the needed support. The Project Manager for Training Devices, Orlando, FL; U.S. Army Aviation Center, Ft. Rucker, AL; and LORAL, Pasadena, CA, pursued the technology and saw the benefits of having aviation equipped for a role at the NTC. The leadership in the 1st Cavalry and III Corps provided the resources and emphasis needed to man and train the TF. And finally, the warriors of TF 1-227 never quit, despite the frustrations of earlier rotations in which they could be killed but not kill.

The personnel of the TF trained hard. The instructor pilots did a superb job with a unit comprising several initial assignment aviators and working with limited aircraft availabil-

ity as a result of storm damage and other causes. The Cavalry Thunder force-on-force exercises at home station; Roadrunner command post exercises; Brigade, III Corps, and Directorate of Evaluation and Standardization/U.S. Army Forces Command aviation resource management survey evaluations were training tools that continued to refine our capabilities. The "eagles" under Lieutenant Colonel Steven Justus and Major Ian Salau provided constant evaluation and critique. This oversight significantly improved our staff and planning processes during the rotation itself.

Maintenance

The combat service support (CSS) also was noteworthy. The required consumption rates for Class V and Class II estimates taken from planning tables and modified by experience proved accurate. The III/V platoon headquarters and service company and armament personnel from D Company aviation unit maintenance (AVUM), augmented by F Company (AVIM) performed superbly. They set up a main forward arming and refueling point (FARP) (4 point) in the tactical assembly area (TAA) (Area Bravo), a heavy expended mobility tactical truck (HEMMT-FARP OR H-FARP) (4 point) and silent FARP (S-FARP) (2 point). The mission never suffered for lack of CSS.

The H-FARP was operational to support the first aircraft. Usually the OH-58Ds or a "vampire" team of AH-64s worked with the OH-58Ds in the predawn hours. The H-FARP displaced to the S-FARP location when phase lines were crossed, after a predetermined time of operation or if under air or artillery attack. This increased the S-FARP capability to four or six points, and made it active. Alternate FARP sites also were identified. CSS planning in-depth was critical, as with battle positions, attack positions, holding areas and engagement areas. The FARP set up out of artillery range, often during darkness and used camouflage well, improving its survivability. Successful training in basic soldier skills; navigation; camouflage; nuclear, biological and chemical; and military occupational specialty (MOS) specific tasks can never be taken for granted. The III/V platoon was augmented from D-227 AVN personnel and from soldiers awaiting activation of other battalions at the Apache training brigade. It is a tribute to these soldiers and their first-line leaders that they became a team so quickly.

The aircraft maintenance effort was crucial from predeployment, to load out, reassembly, tactical operations and redeployment. The companies' AVUM and AVIM; U.S. Army Aviation Systems Command (AVSCOM), St. Louis, MO, logistics assistance representatives; logistics assistance officers; and contractor representatives worked together to keep the aircraft flying and mission ready. The aggressive action on parts through Red River West dramatically reduced down time. Personnel at Barstow-Daggett Airport also assisted with UH-60 maintenance and by providing access to facilities. AVSCOM expedited parts and gave advice that enabled the TF to maintain a high, fully mission-capable rate in a demanding environment, while the Apaches flew 312 hours at the NTC.

Maintenance personnel used handheld radios in the TAA to monitor status quickly and get the right per-

The "eagles" under Lieutenant Colonel Steven Justus and Major Ian Salau provided constant evaluation and critique. This oversight significantly improved our staff and planning processes during the rotation.

Successful training in basic soldier skills; navigation; camouflage; nuclear, biological and chemical; and military occupational specialty specific tasks can never be taken for granted.

Apaches at the NTC

Preventive maintenance contributed to mission accomplishment. Engine flushes and cleaning were a necessity in the dusty environment.

sonnel and equipment to the correct locations during launch and recovery. This technique maximized assets and significantly reduced reaction time. Considering the dispersion in the TAA, the low-density MOSs in aviation maintenance, and contact teams being able to reach the aircraft without their being down first, the radios literally saved hours of repair time over the course of the exercise. We borrowed the radios to assist in airload operations initially, but they were well received in the maintenance role.

Aircraft recovery also worked well using standby crews in the TAA or FARP with either a UH-60 or UH-1 available to respond in minutes. Distances between elements complicated communications. However, the tactical operations center (TOC) or ALOC had to relay to the AVUM or AVIM if there were downed aircraft. The FARP was often out of effective communication range until the tactical activity center (TAC) or Jump TOC (or JTOC) was forward.

Preventive maintenance contributed to mission accomplishment as well. Engine flushes and cleaning were a necessity in the dusty environment. Thorough technical inspections before deployment and upon arrival prevented unnecessary down time. Careful management of aircraft based on flight time expected and required services was a necessity. And last, calibration and special tools and supplies had to be considered and worked so maintenance operations did not stop because of a lack of required equipment. AVIM, AVUM and crewchiefs' tools had to be reviewed, as well as the requirements for all equipment in the TF.

Leadership

The last ingredient was *leadership*. The support of higher headquarters in providing resources and emphasis has been cited already. Equally important was the ability of the battalion task force commander to assess honestly the TF preparedness—in areas of personnel, training, equipment readiness and improvement of MILES/AGES II without pressure and to focus on or prioritize the mission. Certainly numerous other missions were received and completed, but the NTC rotation was the major focus. The leadership task was significant, considering the lack of success with MILES in two previous rotations and early training at Ft. Hood, TX.

In addition, the entire command group and staff were new, since the previous autumn, and had to be molded into an effective, cohesive battle staff. Orchestrating resources, developing and training the personnel and shielding the unit from distractors were significant tasks indeed. The techniques of command and control (C^2) developed as the battles continued. Key elements included the use of

back briefs and map or sandtable rehearsals within the aviation task force and terrain walks and rehearsals by the TF and aviation company commanders with the ground task force commanders. These elements all served to ensure that the commander's intent was understood. The use of decision templates and execution matrices furthered the C^2 process.

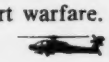
Redundant communication was also instrumental in the TF success. This communication included the use of the TOC and ALOC tracking the battle from the TAA. The S2, S3, and fire support officer were forward with the brigade in a three-vehicle TAC (including VF-MED (variable format message entry device) which helped in fire support). The liaison officer (LNO) was with the brigade TOC and the JTOC (UH-60 with map board). The commander controlled the battle either from the JTOC or an AH-64. The executive officer worked from either the TOC (if the commander were in the JTOC) or from the JTOC (if the commander fought from an AH-64). The S3 was in excellent position and well staffed to control the battle from the ground. He often did, always successfully. The availability of mobile subscriber equipment in the TOC, ALOC, with the LNO and the S3 improved communication capability over reliance on standard frequency modulated radio. The redundancy afforded by these configurations ensured there were always communications with all elements on the battlefield, as demonstrated throughout the battles.

Conclusion

TF 1-227 AVN and NTC Rotation 90-10 changed the NTC for the better. Aviation can play a decisive role in training at the NTC as we know it will on the battlefields of the future. We believe in the survivability and lethality of the Apache and its operational capability, given proper manning and parts availability. The doctrinal employment concepts are valid as found in Field Manual 1-112, *Attack Helicopter Battalion*, e.g., use in the defense against moving armor or against a significant counterattack force.

We worked well in the night and, with OH-58D and JAATs, were effective when the opportunity arose. Attacks and fire missions against Krosnovian assembly areas were not allowed because of boundary rules; hence, deep attacks did not occur—maybe next time! Intelligence preparation of the battlefield; planning in-depth (including CSS); redundant command, control and communication; integration of the total AirLand Battle, understanding commander's intent, rehearsals, battle focus, and synchronization are verities and not just platitudes. The MILES/AGES II is a potent training tool. It needs more improvement, but provides an excellent benefit and credibility among the combined arms team and our own crews.

Persistence pays off and we must continue to refine our training techniques and warfighting abilities. As the force is reduced, we owe our country increased capability with what remains. Effective training and maintenance are the requisites to achieve this. We must encourage continued MILES development and employment of attack battalions at the NTC. (The Battalion must have the proper resources of time, personnel and equipment) so they can prepare to meet the associated demands of desert warfare. "FIRST ATTACK!"



We believe in the survivability and lethality of the Apache and its operational capability, given proper manning and parts availability.

As the force is reduced, we owe our country increased capability with what remains. Effective training and maintenance are the requisites to achieve this.

WINNING IN THE DESERT

PART 2

This article is the second in a series on lessons learned by our servicemembers while conducting operations in Saudi Arabia. Part 1 covered the desert environment, its effects on personnel, and the geography and climate of Saudi Arabia and Iraq. Part 2 discusses environmental conditions and how they affect equipment and personnel operations in the desert. Operating in a desert environment requires knowledge of these environmental extremes and techniques for a higher degree of self-sufficiency. This information should help to prepare our soldiers to fight and win in the harsh desert environment.

Edited from Newsletter, Number 90-7, Special Edition, August 1990, prepared by the Center for Army Lessons Learned, Combined Arms Training Activity, Ft. Leavenworth, Kansas.

ENVIRONMENTAL EFFECTS ON EQUIPMENT

Terrain and Trafficability

Terrain varies from nearly flat, with high trafficability, to lava beds and salt marshes, with little or no trafficability. Drivers should be well trained in judging terrain over which they are driving so they can select the best method of overcoming the varying conditions they will encounter. Some types of terrain can have a severe effect on suspension and transmission systems, especially those of wheel vehicles. Tanks tend to throw tracks on rocks.

Track vehicles. Track vehicles are best suited for desert operations. Wheel vehicles may be acceptable because they will go many places that track vehicles cannot go; however, their much lower average speed in poor terrain may be unacceptable during some operations.

The harsh environment requires a high standard of vehicle maintenance, which may have to be performed well away from specialized support personnel. Operators should be fully trained to operate and maintain their equipment. Items affected by mileage, such as wheels, steering, track wedge bolts, sprocket nuts, and transmission shafts, must be checked for undue wear when completing before, during, and after operation maintenance.

DON'T TOUCH EXPOSED METAL WITH YOUR BARE HANDS; IT'S VERY HOT!

Wheeled vehicles. On rocky deserts, the M54 5-ton truck is prone to air hydraulic cylinder failure and power-steering leaks. Tire consumption is very high, so all vehicles must carry one spare tire or preferably two spare tires. The unit prescribed load list of tires must increase considerably as sand temperatures of 165 degrees Fahrenheit (F) are extremely detrimental to rubber and weaken resistance to sharp rocks and plant spines. About one of every three vehicles should carry jumper cables to provide for servicing dead batteries.

Rubber deterioration. Areas of packed sand, rock and lava beds occur more frequently in Saudi Arabia than in the soft sand desert imagined by many Westerners. This terrain shortens tire life. During each 3-day field training exercise in 1982, the Saudi Arabian National Guard (SANG) modernized 5th Artillery Battery registered a flat tire rate of 40 percent. The rate is about standard for all units.

The majority of flats are attributable to the wear and tear of off-road travel rather than to road heat, high temperature, dryness, potholes, or abuse. Sharp rock itself rarely punctures a tire outright, but it slowly weakens the tire's structure by constant wear on the tread. It may be difficult to detect tire problems when a vehicle is moving fast over rough terrain. A simple, repairable puncture can result in a ruined tire and a bent rim. It is common to see large chunks of tread ripped away after travel over lava rock.

Exercise extra care in driving over lava patches and rough ground. Check tires frequently for signs of wear and cuts. This will necessitate slower movement and tighter control over column spacing to prevent bunching at obstacles.

Vehicle recovery operations. A car or truck can be freed from soft sand by letting about one fourth of the air out of the trapped tires. Reinflate when freed. "Sand ladders" also can be used. These ladders are made of reinforcing rods welded to angle irons. They are about 2 feet long and the width of a truck tire. A shovel may be needed to free sand from around the trapped tires before the ladders can be inserted.

Carry an air pump or sand ladders and a shovel. If available, carry all three. (Sand ladders are usually carried in pairs.) These improve vehicle traction in the desert. Tires are generally kept at

normal road pressure to avoid damage to sidewalls from sharp rocks and to cut down on wear and tear. Increase the numbers of tow bars, ropes and matting in the unit and equip all tactical wheeled vehicles with winches. (Note: Winching out a stuck vehicle has proven to be the most effective means of recovery.)

Another extrication procedure applicable to light vehicles stuck in very fine sand is the "rocking method." Pile sand around all four tires. Three to four men then violently "rock" the vehicle from side to side forcing the vehicle to bounce as high as possible. As the vehicle's weight shifts from side to side, the piled sand will flow under the tires of the vehicle as it is rocked. Eventually, the vehicle will be raised back to the level surface.

Vehicle mobility. The choice of a vehicle used in a desert operation has less to do with mobility than the skill of its driver. A relatively agile vehicle will sink up to the hubs if its driver insists on gunning the engine in soft sand. Conversely, a truck made for use on blacktop will perform acceptably off the road when operated by the driver adept at gearing, speed, braking, and steering.

This assumes operation is in a "mixed" desert of soft sand, packed sand, and rock. No experience exists in operating in dunes; however, it is suspected that, in extensive stretches of soft sand, support vehicles would be greatly slowed by bad footing. Sand, dust and "cap rock" that support the occasional vehicle can become impassable if several vehicles use the same route. The dust cloud also presents a safety problem in reduced visibility for vehicles following in a column.

Well-trained drivers can maneuver a wide variety of vehicles over "mixed" desert without getting stuck. The majority of cross-desert travel should be on line or in echelon. Following another vehicle's tracks is not recommended except when crossing dry washes or as restricted by the topography. Wheeled vehicles should be equipped with extra fan belts, tires, and other items likely to malfunction, together with tow ropes (if not equipped with a winch), extra water cans, and desert camouflage nets. Air recognition panels, signal mirrors, and a tarpaulin for crew sun protection are useful.

Intense Heat and Sunlight

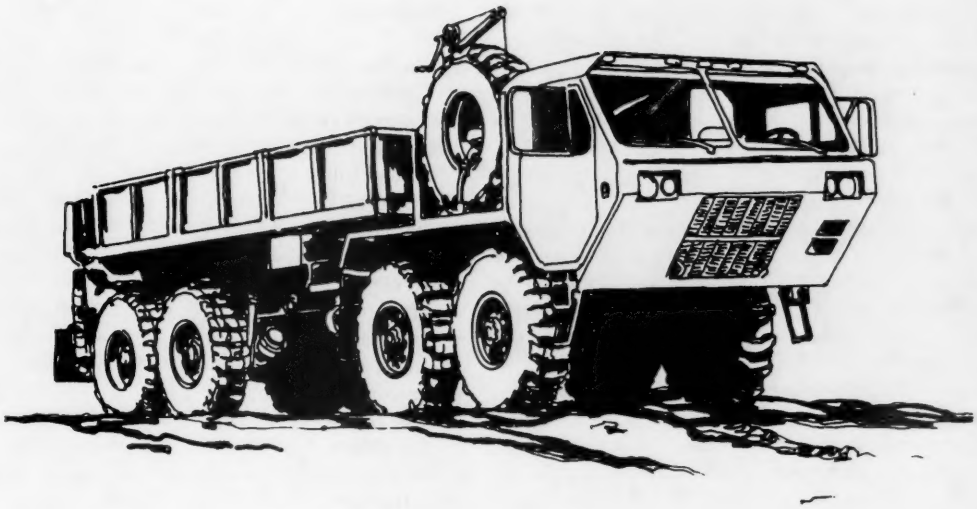
Severe heat increases pressure in closed, pressurized systems, such as the M2 fire burner unit, and increases the volume of liquids. Care must be exercised to ensure that working pressure of all equipment is within safety limits, and caution must be exercised when removing items such as filler caps.

Batteries. Batteries do not hold their charge efficiently in intense heat. Adjust the battery specific gravity (sg) to the environment. The unit can either adjust its electrolyte from 1.200 to 1.225 sg or obtain sulfuric acid, electrolyte, with an sg of 1.2085 to 1.2185. It may also be necessary to adjust the batteries to compensate for cold nights. Technical Manual 9-6140-100-12 contains information concerning these procedures.

Batteries must be kept full, but not overfilled, and a reserve of distilled water should be carried. Air vents must be kept clean or vapors may build up pressure and cause the battery to explode. Voltage regulators should be set at the lower end of the specifications.

Portable training devices and life support equipment that rely on batteries malfunction frequently unless the batteries are kept out of direct sunlight. Heat quickly discharges the stored energy in batteries. Although power generators are an alternative, they can also cause problems. When exposed to extreme heat, wind, and windblown sand, they become a maintenance nightmare.

Specific devices immobilized by electrical problems for the above reasons include target mechanisms, radios, and remote control units. Vehicle batteries have been found to go dead after relatively short periods of vehicle inactivity (5 to 10 days).



Whenever possible, hard-wire stationary electrical devices to commercial power sources. Exercise vehicles regularly.

Ammunition. You must keep ammunition away from direct heat and sunlight. If it can be held by bare hands, it is safe to fire. White phosphorus ammunition filler tends to liquefy at temperatures over 111 degrees F, which will cause unstable flight unless projectiles are stored in an upright position.

Experience indicates that artillery ammunition is consumed in greater quantities than would normally be expected in a different environment. This is due to the expansive open terrain upon which an engagement would probably occur. Erratic ballistic behavior has been observed on artillery and tank rounds due to excessive heat.

Increase consumption planning for artillery and antitank ammunition. Ammunition should be stored in areas with a double sun shade. Whenever possible, in addition to the double sun shade, the ammunition should be stored approximately 1 meter below the desert floor. This method reduces the ambient temperature in the storage site below 100 degrees F.

Radios. All radios, regardless of type, must be kept cool and clean. They must be placed in the shade when possible and in a ventilated area. If water is available, lay a damp towel on top of the radios, making sure that the air vents are not blocked. Radio operators should obtain a paint brush they can use to keep their radios clean.

Desert tactics require dispersion, but the environment is likely to degrade transmission ranges. This degradation is most likely to occur in the hottest part of the day. If you start to lose contact, especially if noon is approaching, you must have alternate ways in which to communicate.

Some radios automatically switch on their second blower fan if their temperature rises too high, which normally only happens in intemperate climates when they are transmitting. Amplifiers are liable to severely overheat and burn out. Such equipment should be turned on only when necessary (they do not affect receiving), as they take about 90 seconds to reach the operating mode.

Thermal cutouts. Some items of equipment are fitted with thermal cutouts, which open circuit breakers when equipment begins to overheat.

Medical supplies. During movement and at operation sites where extremely hot temperatures exist, continuous protection is necessary for medical items and supplies which deteriorate rapidly.

Radiant light. Radiant light, or its heat effects, may be detrimental to plastics, lubricants, pressur-

ized gases, some chemicals, and infrared tracking and guidance systems. Items like carbon dioxide fire extinguishers, M13 decontamination and reimpregnating kits, and all types of missiles must be kept out of constant direct sunlight. Optics have been known to discolor under direct sunlight (although this is unusual). It is wise to minimize their exposure to the sun's rays.

Dust and Sand

Dust and sand are probably the greatest danger to the efficient functioning of equipment in the desert. It is almost impossible to avoid dust and sand particles settling on moving parts and acting as an abrasive.

Mechanical equipment. Lubrication must be the correct viscosity for the temperature and kept to the absolute minimum in the case of exposed or semi-exposed moving parts. Sand mixed with oil forms an abrasive paste. Lubrication fittings are critical items and should be checked frequently. Teflon bearings require constant inspection to ensure that the coating is not being removed. Maintenance of engines is critical because of the strong possibility of sand or dust entering the cylinders or their moving parts when the equipment is stripped.

It is essential to have screens against flying sand (which will also provide shade for mechanics). Mechanics must keep their tools clean and out of the direct sunlight as hot tools are uncomfortable to handle. The use of high pressure hoses may force sand and dust into seals and bearings.

Filtration. It takes relatively little dirt to block a fuel line, and compression-ignition engines depend on clean air. The abrasive effect of sand in oil has been mentioned.

Air cleaners of every type of equipment must be examined and cleaned at frequent intervals. The exact interval depends on the operating conditions, but should be at least daily.

Filters must be used when refueling any type of vehicle, and the gap between the nozzle and the fuel tank filler must be kept covered. Fuel filters will require frequent cleaning. Oil filters will need replacement more frequently than usual. Engine oil will require changing more often than in temperate climates.

Electrical wire insulation. Wind-blown sand and grit soon damage electrical wire insulation. All cables that are likely to become worn should be protected with tape before insulation becomes worn. Sand also finds its way into parts of items such as "spaghetti cord" plus, either preventing electrical contact or making it impossible to join the plus together. You should carry a brush, such as an old toothbrush, to clean out such items before they are joined. Additionally, a pencil eraser works wonders on antenna connections.

Weapons. Weapons may become clogged or missiles jammed on launching rails because of dust and sand accumulation. Sand or dust clogged barrels can lead to inborn detonation. Muzzles must be kept covered by a thin cover so an explosive projectile can be fired through the cover without risk of explosion. Working parts of weapons must have the absolute minimum of lubrication. It may even be preferable to have them totally dry.

Optics. All optics are affected by blowing sand, which gradually degrades their performance because of small pitting and scratches. Guard against buildup of dust on optics, which may not be apparent until the low-light performance has substantially deteriorated. It may be advisable to keep optics covered with some type of plastic wrap until operations determine their use. Whenever possible, use the soft brush in the basic load list to clean optics. If possible, use a low air pressure system to blow all sand out before wiping or dusting to prevent scratching of the lens.

Sand accumulation. Sand and dirt can easily accumulate in hull bottoms of armored vehicles. This accumulation, combined with condensation or oil, can cause jamming of control linkages. Sand at the air bleeder valve can inhibit heat from escaping from the transmission and result in damage to the transmission. The operator's checks and services increase in importance in this kind of environment.

DON'T LET SAND MIX WITH OIL—LIKE A GRINDING WHEEL, IT CAN WEAR METAL!

Communication equipment. Dust affects communication equipment such as amplifiers and radio teletype sets. The latter, especially, is prone to damage due to its oil lubrication, so dust covers should be used whenever possible. Some receiver-transmitters have ventilating ports, and channels that can get clogged with dust. These must be

checked regularly and kept clean to prevent overheating.

Humidity

Some deserts are humid. When this is the case, humidity plus heat encourages rust on bare metal parts and mold in enclosed spaces such as optics. Bare metal surfaces on equipment not needed for immediate use must be kept clean and very lightly lubricated. Items such as optics must be stored in dehydrated conditions using desiccants; those being used should be kept where air can circulate around them.

DON'T DEHYDRATE.
DRINK PLENTY OF WATER!

Condensation. In deserts with relatively high dew levels and high humidity, overnight condensation can occur when surfaces, such as metal, are exposed to warmer air. This condensation can affect items such as optics, fuel lines, and air tanks. Fuel lines should be drained both night and mornings; optics should be cleaned frequently. Weapons, even if not lubricated, will accumulate sand and dirt because of condensation—another reason for daily cleaning.

HUMIDITY CAUSES FEET TO PERSPIRE, THEREFORE, CHANGE SOCKS FREQUENTLY OR YOU MAY DEVELOP TRENCH FOOT, A PAINFUL DISABLING FOOT DISORDER.

Desert fog. In the desert, temperature fluctuation, and moisture in the air may produce fog that forms a belt. The fog may move rapidly through an area of operation or hang suspended for extended periods. In numerous instances, this desert fog disrupts operations.

Because visibility is cut to almost zero during desert fog, vehicle operations, land navigation, target acquisition, enemy observation, and direct fire are seriously affected. However, units with thorough knowledge of the terrain in their areas of operation can effectively use this fog to disengage from the enemy, or conduct raids or ambushes.

Optics. Optics in central Saudi Arabia are completely free of moisture-related problems. However, in areas adjacent to the Arabian Gulf and the Red Sea, problems with condensation and moisture occur more often than usual. The major threat to optics is wind blown sand, which gradually degrades its performance by pitting and scratching the lenses.

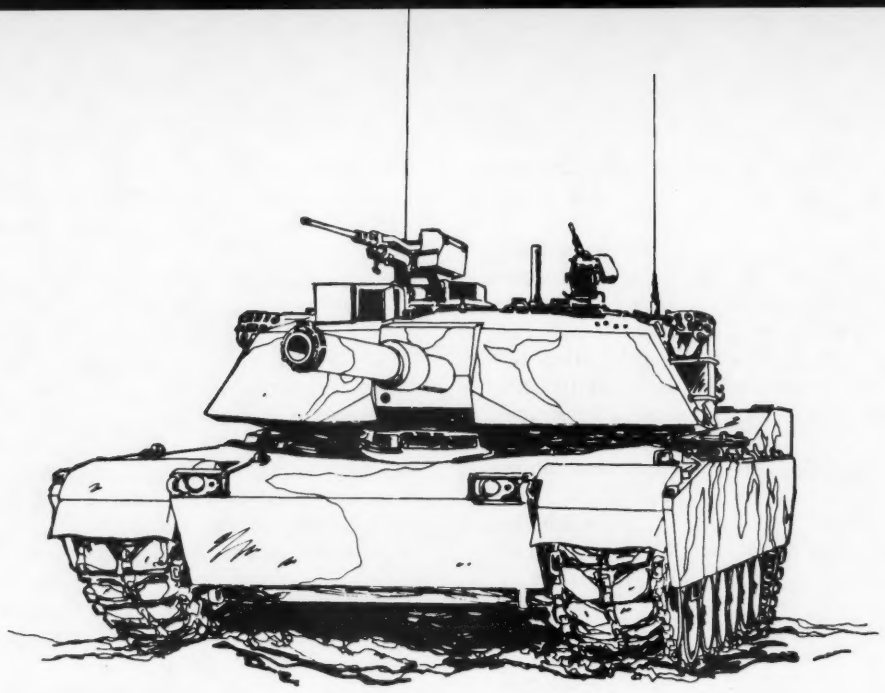
Regular maintenance and inspection of optics will help eliminate or control moisture-related problems. Lens covers should be used to prevent damage from dust and blowing sand. If possible, keep the system completely covered until ready for use.

Temperature changes. Air and all fluids expand and contract according to temperature. If you inflate tires to correct pressure during the cool night, they may burst during the heat of the day. If fuel tanks are filled to the brim at night, they overflow at midday. Servicing these items during the heat of the day can result in underpressure, overheating of tires, and a lack of endurance if the fuel tanks are not filled to their correct levels. Find the midpoint of the temperature range during the day and check pressures and fuel levels at that time of the day. Locate the fill line on fuel tanks and do not overfill.

Precision instruments, such as range finders, may require adjustment several times during the day depending on the temperature variation.

Static electricity. Static electricity prevails in the desert. It is caused by dry air coupled with an inability to ground electric charges because of dryness of the terrain. It is particularly likely with aircraft or vehicles having no conductor contact with the ground. The difference in electrical potential between separate materials may cause a spark between them. If flammable gases are present, they may explode and cause a fire. A metal circuit must be made between tankers and vehicles being refueled; contact must be maintained during refueling; and the equipment must be grounded.

A further hazard of static electricity is with helicopter sling loads. The hook should be allowed to touch the ground before being loaded and a load grounded before being unhooked. It is also necessary to turn off all switches, uncouple electrical connectors, and ground all electrically operated weapons systems before rearming.



OPERATIONS UNDER DESERT CONDITIONS

Vehicular Desert Survival Kit

Military vehicles operating in a desert environment must have a higher degree of self-sufficiency than would normally be expected in a different environment because of environmental extremes. Essential equipment is listed at right.

Batteries

Because local water in central Saudi Arabia is highly saline, supply units are often called upon to provide "sweet" water (that is, drinking water) for cleaning and maintenance. Saline water calcifies in automobile cooling systems, reducing cooling capacity. It corrodes metals when used for washing.

Oil changes and lubrication of undercarriage points at more frequent intervals will prolong engine and vehicle life under desert conditions.

Vehicle Cooling and Lubrication Systems

Operations in hot weather or on rough terrain increase the chances an engine will overheat. Lengthy high-speed operation, hard pulling operations, and low-gear negotiation of steep grades or soft sand have caused over heating. Cooling system efficiency drops with the calcification of water

Desert Survival Kit for Vehicles

1. **Operational vehicle equipment to include a small general tool kit**
2. **Flashlight and triangular highway reflector**
3. **Fire extinguisher**
4. **Compass, binoculars, and maps**
5. **Communications equipment**
6. **Shovel, sand ladders, and tow rope/cable (at least 25 feet long)**
7. **Five gallons of water per vehicle occupant**
8. **Personal food, clothing, and equipment**

channels caused by use of water with high mineral content. Poor cooling will also result from dirt between radiator cooling fans.

Avoid continuous use of vehicles in low gear range. Replenish radiators with potable water except in emergencies. Blow dirt out of radiators with compressed air or a jet of water.

Vehicle cooling systems and lubrication systems are interdependent. The malfunction of one will rapidly place the other under severe strain. All types of engines are apt to overheat to some degree, leading to excessive wear and ultimately leaking oil seals in the power packs.

Commanders should be aware which vehicle types are prone to excessive overheating and ensure that extra care is applied to maintain them. Temperature gauges may read between 10 to 20 degrees hotter than normal. Don't panic if your average operating temperature is 180 degrees and, when operating your vehicle, the gauge shows 200 degrees. Monitor the gauge. If the temperature keeps rising, put the vehicle in neutral and rev the engine up to approximately 1,200 RPMs until the gauge drops back down.

Check oil levels to ensure that levels are what is required. Too high may be as bad as too low. Check to ensure seals are not leaking and oil consumption is no higher than normal. Keep radiators and air flow areas around engines clean and free of debris and other obstructions. Water-cooled engines should be fitted with condensers to avoid waste as steam through the overflow pipe. Keep cooling systems' hoses tight. A drip a second is 7 gallons in 24 hours.

Operators should not remove hood side panels from engine compartments while the engine is running. This will cause turbulence which leads to ineffective cooling.

Lubrication of vehicles. Oil should be changed about twice as often as recommended, not only because grit accumulates in the oil pan, but also because uncombusted low-octane fuel seeps down the cylinder walls and dilutes the reservoir.

Diluted oil lubricates and cools less effectively and evaporates at high temperatures generated during engine operation. This makes frequent topping up necessary. High-grade 20W-50 oil serves well in desert conditions.

Vehicle filtering systems. Air, fuel, and oil filters require daily servicing in the desert. Ambient air that appears clean is actually laden with fine dust, even on a clear day. Replacement of all filters must be done more frequently than recommended. Close attention to filters pays in fewer maintenance problems. It is not uncommon for an air filter to become completely useless in 3 days even with daily or more often cleaning. Greater numbers of filters of all types should be stocked for use in desert operations.

9. Siphoning hose (1/2-inch outside diameter by 6 feet) and funnel

10. Slave cables (one for each group of vehicles)

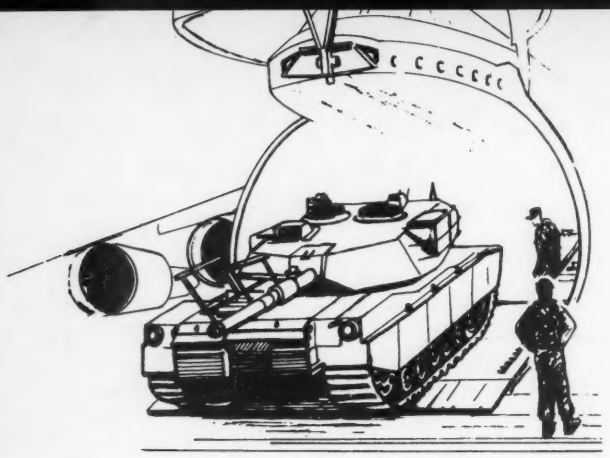
11. Mounted vehicular air compressor with air reservoir (150 psi) and sufficient air hose

12. Jack support plate (1 foot by 1 foot piece of metal)

13. Consumables, to include oil, radiator hoses, fan belts, heavy duty tape, air and gas filters, twine, annealed wire

CLEAN AIR FILTERS DAILY.
DON'T LET SAND ACCUMULATE.

Fuel contamination. One source of fuel contamination is the SANG's reuse of gasoline tankers to transport or store diesel fuel, and vice versa, without first flushing. The Saudi government owned fuel company, Petromin, controls the only facility in the country for flushing out tankers. Because there is no other place to perform this service, the pressure of operational necessity often forces driver to skip this important procedure. If a unit is required to flush a tanker to transport a different product, the availability of local facilities should not be included in the planning.



POL storage. Operation of mechanized forces in the desert will require a considerable number of petroleum, oil, and lubricants (POL) storage sites. In most desert areas in Saudi Arabia, storage systems are antiquated. Devices for determining the state of POL contamination may be lacking. As an example, local systems are not equipped with sampling and gauging hatches. Standard U.S. sample beakers will not fit down refill hatches. The local storage tanks also have no strapping charts for determining the precise volume from tank fluid levels. Bottom samples cannot be drawn up to test for contamination.

It is not possible to determine the precise volume of fuel in local storage tanks. Nor is it possible to determine the degree of contamination without special equipment.

Lubrication of Weapons

Some field-experienced personnel strongly believe that soldiers operating in the desert should not lubricate any weapon unless it is being taken into combat immediately. Conventional lubricants attract more dust and dirt than if the weapon were left dry. There is no danger of rust most times of the year. Especially conscientious soldiers stuff oily rags down barrels or wrap the rags around jam-prone mechanisms. Weapons system manufacturers continue to recommend generous lubrication in their consulting visits to SANG, emphasizing that lack of lubricant affects the weapon both in storage and in operation.

Weapons should be lubricated in accordance with U.S. standards while in storage; when weapons are in use, they should not be heavily lubricated.

TOW Antitank Weapon

Some observers have complained that the TOW antitank weapon kicks up an excessive dust signature with its backblast. The complaint does not deserve a great deal of attention, since the TOW is such an effective weapon overall. If it is placed intelligently (that is, away from soft sand), its visibility to an enemy would be minimal. Furthermore, in the heat of battle, dust would be generated by anything moving. This would camouflage the signature made by TOW.

TOW is a highly effective antitank weapon in the desert. Its dust signature, albeit a consideration, is not a serious drawback.

Repair Parts Usage

Dust, sand, rough terrain and temperature extremes cause an estimated 50-percent increase in repair parts required to support a combat unit. Parts subject to friction fail with greater frequency in the desert than under U.S. or European conditions. In this category are practically all engine parts, brake shoes, upper and lower control bushings, wheel bearings, and carburetors.

Carburetor failure can be forestalled by preventive maintenance. Vehicles parked for long periods in the sun tend to sustain damage to exposed plastic and rubber-like dashboard tops, wipers, and trim. Rubber seals are prone to dry rot. A combination of heat and dryness makes plastic parts in the engine compartment particularly susceptible to breakage.

Mechanics will need additional stocks of friction bearing parts, plastic and rubber parts, and rubber seals. Also, cracking and breaking of cast metal parts is common due to constant excessive vibration during operations.

Optical Illusion

A person standing on a hill 300 meters high can see, depending on the landscape, for 20 or 30 kilometers (km) on a clear day. But land that looks flat from the hill actually has two ridgelines in that distance. The uniform color of the land and the even lighting at midday make it difficult to distinguish changes in elevation at great distances.

The effect is similar at near range. Soldiers frequently aim at an enemy vehicle with a recoilless rifle without noticing the stretch of low ground in between. The round falls short. It is not a question of carelessness, but of optical illusion. This affects range estimation and targeting.

The casual observer frequently will miss intermediate features in the landscape. Observers must

think about what they see and look for the unexpected. Such problems in observation decrease, at dawn and dusk, when shadows define terrain features.

Route Reconnaissance

To compensate for a lack of adequate maps, it is best to reconnoiter desert operations areas in advance of large-scale troop movements. Route reconnaissance is especially important to field artillery. Alternate and supplemental positions should be planned. Go over and mark proposed and alternate routes.

If at all possible, guides should return to the main element at the completion of the reconnaissance to help the unit adhere to the prescribed routes of march. Deviation from planned routes can cause lengthy delays and breakdowns that will ultimately degrade available fire support.

Thorough ground reconnaissance and adherence to prescribed routes of march will improve artillery fire support in desert operations.

Routes of March

The interior of Saudi Arabia has few hard surface roads. Many of them are not well maintained. Secondary gravel roads and trails crisscross the landscape; however, they too are not maintained and quite frequently are like driving on a "washboard." Except for the main arteries, there are few road signs or trail markers except those constructed by the Bedouins. Routes of march will quite often be cross-country over rugged and changing terrain with only partially adequate maps and a compass.

Wire Deterioration and Usage

Field wire (WD-1) is used to supplement 32-pair wire in the SANG field telephone system. Problems arise in attempting to maintain a continuous circuit and a reliable land-line communications system. Heavy vehicles driving over buried wire cause breaks and cuts. Dry rot on insulation exposes wire. It then will not conduct or at best conducts poorly, resulting in dead or intermittently operational lines. Also, irregular tension on lines causes connections to pull away, breaking the communications link.

Shielded cable is more sturdy and reliable than wire presently used by the SANG. Shielded cable is less prone to the problems listed above and would more effectively maintain telephone communications under desert conditions.

Dispersion

Any bunching of vehicles in open areas is easily detected at ranges up to 10 km from the air or high vantage points. Unit elements should be dispersed to the greatest degree possible using all available natural cover and concealment.

ENVIRONMENTAL EFFECTS ON PERSONNEL

Eye Protection

The importance of wearing eye protection in the desert cannot be overstressed. Some people prefer sunglasses; others like goggles. Both have advantages and disadvantages, but both accomplish the goal of keeping out direct and reflected sunlight and reducing the numbing effect of cold winter winds. Be sure to wear sunglasses or goggles in the desert.

Consumption of Liquids

Unacclimated Westerners dehydrate extremely rapidly in the desert. The only sure solution is forcing fluids—drinking fluids even when not apparently thirsty on some sort of schedule, if possible. Experience indicates if a man feels thirsty in the desert, he is already on the borderline of trouble. The Arabs drink a very sweet, hot tea. It is probably good to imitate them.

> FORCE LIQUIDS. DRINK WATER EVEN IN THE ABSENCE OF THIRST.

Bad Water

There have been a few cases of gallstones and other urinary disorders among Westerners following completion of extended periods in central Saudi Arabia. Some persons have linked these illnesses with local water, which is high in mineral content. Purified water is available for drinking; however, it too affects certain sensitive individuals. Expect a higher than normal incidence of urinary disorders, possibly as a result of poor drinking water.

Eating Habits

Fresh fruit and ice cream definitely raise people's spirits and brighten the menus on long maneuvers. It is a problem to transport and preserve these foods in the desert heat; however, the payoff in improved morale is worth the trouble. Certain foods, though hard to keep under desert conditions, have intangible value to personnel in the field. These foods should be set aside before an operation for shipment to key elements at the right time.

Jet Lag

People arriving in Saudi Arabia from the United States need at least 2 or 3 days' recovery time after the long flight. Jet lag affects eating and sleeping habits, mental agility, and general attitude. A newcomer cannot "hit the ground running."

Jet lag is a serious consideration in desert operations for people arriving by plane from a great distance. A recovery period should be allowed, ideally 1 day for every time zone crossed.

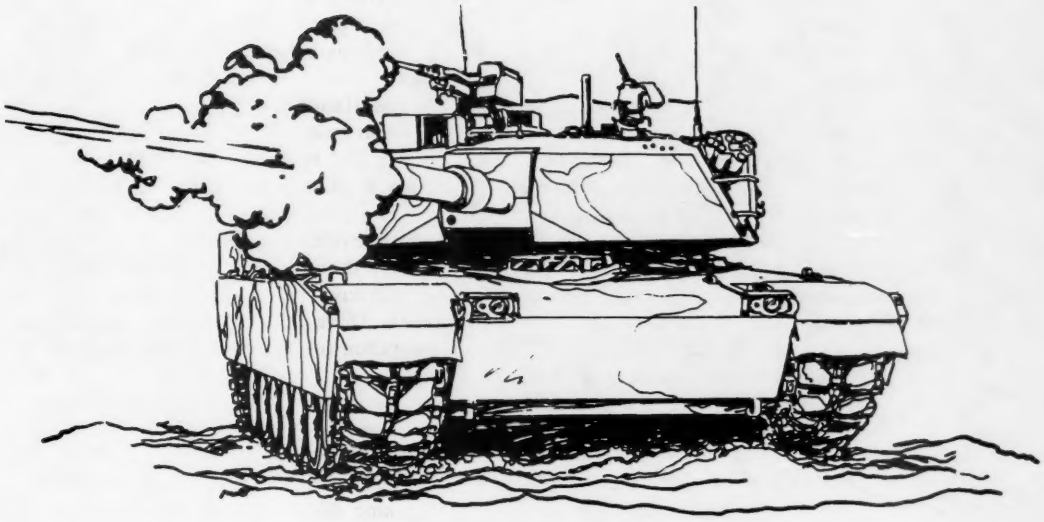
Respiratory Disorders

The air, even on a clear day, is laden with dust particles that trigger sinus problems and other respiratory ailments. It is not practical or feasible to attempt to filter out the dust particles on a daily basis; however, on particularly bad days, do don surgical masks or cover your nose and mouth with a bandanna to reduce the intake. Expect a higher than normal incidence of respiratory disorders.

Nonpotable Water

There are isolated open wells in some of the wadis. Abundant water is available only from wells that are drilled to tap underground rivers and lakes at depths of 3,000 to 8,000 feet. The water from this source has an extremely high mineral content which makes it unsafe to drink.

Plan on supplying unusually large quantities of drinking water because of the unsuitability of local water for drinking, cooking, cleaning, and maintenance. Experience in the SANG battalions indicates that a unit will require at least 7 gallons of water per man per 24-hours.



TIPS ON FIGHTING IN THE DESERT

Intelligence

Distances require longer lead times to plan for effective reconnaissance and surveillance.

To confirm the intelligence template, the reconnaissance must identify (to a 6-digit accuracy) about 80 percent of the enemy antitank systems.

Scouts are reconnaissance patrols, not combat patrols, and should attempt to gain information through stealth.

Consider conducting reconnaissance during periods of limited visibility.

Few civilians are encountered in desert operations. Treat the information they give you with caution.

Maneuver

When one moves in the desert, cover can only be provided by terrain masking because of the lack of heavy vegetation or manmade objects.

Because there is little vegetation in the desert, strong shadows are readily observed from the air.

Disrupt shadows by altering the shape of equipment. Use the correct angle to the sun to minimize shadow size and to cause shadows to fall on broken ground or vegetation whenever possible. Dig in equipment and use overhead cover or camouflage nets to reduce shadows.

Move vehicles and equipment as the sun moves.

Shade optics to prevent shine.

Open terrain and predominantly clear atmosphere generally offer excellent long-range visibility, however, at certain times of theday, the effects of heat may limit or distort the atmosphere. The ideal observation position should have the sun behind it and be as high as possible to lessen the effects of mirages and heat radiation from the ground.

Stake out your target line or engagement area (trigger point). This will prevent soldiers from engaging targets beyond the maximum effective range of the weapons.

Observation of fires may be difficult. The lack of visible terrain features may distort your ability to estimate range. When preparing defensive positions, use every available means to know how far you can observe in front of your positions.

The enemy can see just as far as you can. Inspect your position from an enemy's point of view.

Light and noise at night may be seen or heard from miles away; therefore, strict light and noise discipline are necessary.

Essential noise such as that produced by generator motors must be muffled and kept to a minimum by digging in or sandbagging the generator.

Sand and dust reveal movement in the desert. It is best to move at night. This includes resupply as well as tactical movements.

Sand obscures landing zones, distorts depth perception, and can disorient pilots.

The fewer terrain features in the desert hinder navigation and expose friendly forces to the enemy.

Take advantage of features such as wadis to conceal movement. Always camouflage positions.

Fire Support

Artillery ammunition storage and handling is important in a dry, hot environment. Hot ammunition affects the ballistic solution, which causes the round to impact long or short of its intended target. Dig in storage positions to keep ammunition cooler.

Use illumination or smoke rounds to reorient maneuver forces. The fire support coordinator plans and coordinates all fires in the maneuver area of operations; i.e., mortars; Air Force, Marine Corps, and Navy close air support; naval gunfire; and attack helicopters.

Mobility/Countermobility/Survivability

Because of lack of natural obstacles and excellent trafficability of the entire region, units should use linear obstacles to stop enemy movement.

To be efficient, minefields must be laid rapidly over large areas.

The enemy will try to attack with the sun low and behind him in an attempt to dazzle the defender.

Engineer units must plan on having two operators for each piece of equipment because of extra maintenance requirements and harsh working conditions.

Especially in open terrain, survivability positions are normally more important than antitank ditches.

A tank platoon properly dug into two step positions can destroy a battalion. As such, earth-moving assets should focus initially on survivability positions.

Normally infantry works on digging in before assisting engineers in placing mines. Engineer soldiers normally focus entirely on obstacles.

Once completing crew-served positions with overhead cover, the task force reinforces engineer soldiers, emplacing obstacles to the maximum extent possible.

Employ "basic loads" of Class IV, such as sand bags or pickets, with all vehicles to expedite rapidly digging in. The S4 must push forward replacement basic loads during transition to the defense in standard infantry platoon packages.

Camouflage and dispersion are necessities for all forces. Employ reverse slopes as much as possible and camouflage frontal parapets for individual or crew positions. This avoids the obvious bunker positions easily seen and destroyed by direct fire.

Strong winds increase evaporation of liquid agents and cause chemical clouds to act similarly to radioactive fallout over shorter distances.

Extended depth and dispersion of vehicles enhances your chance of survival.

Mission-oriented protection posture discipline and soldier reaction to chemical agents enhance survivability.

Engineers should carefully reconnoiter routes of march to avoid needless destruction of roadways, bridges, and pipelines.

Armored vehicles survive longer when dug in. To fight outnumbered and win in the desert, we must stress survivability positions.

Use of dummy positions can conceal operational plans and deceive the enemy as to the real location of potential targets such as fighting positions or training areas.

High desert temperatures day increase the incapacitating effects of liquid agents, which rely on skin penetration, in a comparatively small area around the target.

Air instability is most likely to cause quick, vertical, and irregular dissipation of an agent, leaving the target area relatively free of contamination quickly.

Chemical weapons used during the heat of the day are normally persistent nerve or blister agents.

Strong winds can increase the evaporation of liquid agents and cause chemical clouds to act like radioactive fallout.

Air Defense

Airspace management difficulties are compounded in the multinational environment. Stand-

* U.S. G.P.O. 1991-531-042:20006

ing operating procedures must be exchanged to formalize airspace policy.

Adequate coordination with host nation forces within the battlefield coordination element (BCE) cannot be affected without host nation liaisons with the BCE.

Camouflage and dispersion are of the utmost importance to air defense systems. Direct sunlight can affect the Stinger system.

Combat Service Support

Medical support of the defense is associated with great distances. Depth and dispersion of the defense create significant time/distance problems.

In a nonlinear desert defense, enemy and friendly units are intermingled, especially in poor visibility.

Medical treatment and evacuation become more critical in the desert. The effectiveness of the combat lifesaver program has been proven.

Medics must constantly recertify and train those who are designated as combat lifesavers. The standard number of medics is at least one per squad. Rehearse how your unit will identify, treat, and evacuate casualties. This is as important as how you will fight.

All weapons must be cleaned constantly.

When not in use, keep weapons covered. Even though weapons are covered, they may still have sand on them. Clean weapons frequently so they will be ready when needed.

Preventive maintenance checks and services in the desert are absolutely essential. Left unattended, sand and wind rapidly destroy the most basic piece of soldier gear.

Sand clogs fuel lines and wears out tires and other rubber and plastic parts faster. Sand also seeps into engines and cooling systems. This results in overheated engines, which can cause sudden and catastrophic failure.

Food service organizations require intense supervision. Current menus must be augmented with fresh fruit, vegetables, and breads to provide soldiers the roughage and nutrients they need.

Command and Control

Commanders should operate where contact can be maintained with forward units in critical spots and with the tactical operations center.

Desert evenings can be long or short. Leaders should be concerned with end-of-evening nautical twilight, beginning morning nautical twilight, and percentage of illumination. These factors are extremely important when fighting night battles.

Dry desert conditions can, at times, reduce radio signal strength and create unforeseen blind spots, even in aircraft operating nap-of-the-earth.

Frequency modulated communications may be degraded because of dead spots caused by heavy concentrations of minerals close to the surface. Establish firm procedures for constant control of communication, either by radio or through liaison.

When all personnel know the commander's intent and rehearse battle drills, they will understand the actions, even without good communication.

UNITED STATES ARMY
AVIATION DIGEST

Author's Guide

Manuscripts

Aviation-related articles are not restricted in length, but should be original, unpublished manuscripts. Manuscripts may be handwritten, typed double-spaced or keyboarded, preferably in WordPerfect 4.2 or 5.0 on a 5¼-inch diskette. However, other word processing programs (MultiMate or WordStar) are acceptable. Please send two dark hard copies. Manuscripts should contain no classified material and should be cleared through the author's local chain of command and Public Affairs Office before submission.

The *Aviation Digest* staff also will clear most articles through appropriate channels. We reserve the right to edit your article to ensure it conforms to our style and does not exceed a 12.9 reading grade level. If acronyms are used, please identify each as well as titles of regulations or books.

Graphics

Appropriate graphics enhance the reader's understanding and are important in clarifying most manuscripts. Clear, sharp photographs are important. If available, photographs (5 x 7 glossy black and white prints are preferred, negatives are acceptable, and 35mm slides only as a last resort). Figures should be included as well as accompanying captions typed on a separate sheet of paper explaining each photo, figure or illustration.

If unavailable, any ideas for artwork should be included in the form of sketches or rough drawings. Specific questions on artwork or photos should be directed to Fred Martin, AUTOVON 558-3619 or Commercial 205-255-3619.

Subjects

Potential themes (subjects) for the near future are force structure; i.e., appropriate mix of heavy, light and special aviation operational forces in the Active and Reserve Components; leadership; development of quality soldiers; Desert Shield Operations; aviation-related history; safety; aircraft accident prevention; equipment and rescue/survival gear; air traffic control; doctrine and training; maintenance; research and development; communications; aviation medicine; operations; military aviation personnel information; human factors engineering; and any other issues pertinent to the Aviation Branch.

Although we play up a central idea in each issue, we are not theme-restricted. We publish timely, thought-provoking, factual information on Army Aviation plans and policies, regardless of their relevance to the central idea (theme).

Authors

If you have any ideas for an article, or editorial questions, call AUTOVON 558-3178/3619 or Commercial 205-255-3178/3619. Authors should include their name, address, present or past duty position (whichever is appropriate for basis of writing the article), AUTOVON and or commercial phone number(s) for contact if further information is necessary, and a brief biographical sketch.

Mail To:

Editor
U.S. Army Aviation Digest
ATTN: ATZQ-AP-AD
Building 602
Ft. Rucker, AL 36362-5042